Commonwealth of Massachusetts

Executive Office of Environmental Affairs

Division of Fisheries and Wildlife

Biodiversity Initiative—Forestry Program

Draft Resource Management Plan

Berkshire Highlands Forest Management Zone

September 19, 2005

Prepared by
Brian Holt Hawthorne, DFW Management Forester
Anne Marie Kittredge, DFW Management Forester
John J. Scanlon, DFW Forest Project Leader
James DeNormandie, DFW Forestry Project GIS Analyst

Table of Contents

List of Tables

List of Figures

Executive Summary

The Division of Fisheries and Wildlife (DFW) is responsible for the stewardship and management of >130,000 acres of state wildlife lands. DFW has identified nine Forest Management Zones (FMZs) across Massachusetts that are based on U.S. Forest Service Ecoregion boundaries. Each FMZ includes multiple DFW properties, and the Berkshire Highlands FMZ includes more than 33,000 acres in 36 properties. A combination of ecological, socioeconomic, and administrative factors led DFW to combine the following four ecoregions which span the two ecological provinces in Massachusetts into the Berkshire Highlands FMZ: the Southern Green Mountains, Berkshire–Vermont Highlands, and Vermont Piedmont ecoregions in the New England–Adirondack Province and the Berkshire Transition Association of the Hudson Highlands Ecoregion in the Eastern Broadleaf Forest (Oceanic) Province.

The hierarchy of forest management planning on DFW lands begins with DFW's statewide "Forest Management Guidelines for Wildlife Management Areas" (Scanlon et al 2000), followed by ecoregion assessments of forest resource issues and opportunities on public and private lands compiled by the Massachusetts Executive Office of Environmental Affairs (EOEA). Next, individual FMZ plans provide an assessment of current forest conditions and identify a desired future condition that will achieve DFW's wildlife habitat goals. FMZ plans propose forest management and monitoring activities that will achieve the desired future conditions and monitor the outcome of management activities. FMZ plans identify active and passive management sites on DFW land. Active management sites provide young forest habitat, enhanced structural habitat attributes (e.g., snags, den trees, and coarse woody debris) and a sustainable flow of wood products. Passive management sites include forest reserves that provide biologically mature forest habitat, facilitate assessment of sustainable harvesting practices, and provide aesthetic, recreation, and spiritual opportunities. FMZ plans are followed by property level plans (site plans) for individual DFW Wildlife Management Areas (WMAs), then by Ch. 132 Forest Cutting Plans for actively managed stands within an individual WMA.

DFW properties in the Berkshire Highlands FMZ are characterized by 60-90 year old forest, including more than 23,000 acres of northern hardwood forest with mixtures of white pine-hemlock and some spruce-fir; >800 acres of wetland forest; >1,200 acres on non-forest wetlands, and >500 acres of abandoned field, grassland, and shrubland habitats. DFW forest composition goals recommend 15-20% young forest habitat (seedling, sapling, and small-pole forest), and 10-15% biologically mature (typically >150 year old) forest habitat. DFW properties in the Berkshire Highlands FMZ currently contain substantially less young and less biologically mature forest habitat than desired. Accordingly, >15,000 acres are devoted to even-aged silviculture to create adequate young forest habitat, and 10,640 acres have been proposed as forest reserves. The proposed acreage of forest reserve exceeds forest composition goals for this FMZ. Proportionately fewer acres of forest reserves will occur in other FMZs to achieve statewide landscape composition goals. Management activities require environmental permit compliance, soil and water conservation, rare species protection, public recreation opportunities, and conservation of historical and cultural resources.

I. Background

1. DFW statutory responsibilities

The Division of Fisheries and Wildlife (DFW) has statutory responsibility for the conservation—including protection, restoration and management—of Massachusetts' flora and fauna (Darey and Jones 1997), and is responsible for the stewardship and management of over 130,000 acres of state wildlife lands.

Specifically, as an agency of the Executive Office of Environmental Affairs (EOEA), the Division of Fisheries and Wildlife (DFW) is empowered by Massachusetts General Law (MGL), Chapter 21A, section 2, sub-section 3 to "provide for the propagation, protection, control and management of fish, other aquatic life, wildlife, and endangered species", and under sub-section 15 to "manage all lands and properties acquired by or assigned to [DFW] to preserve their natural beauty, wilderness, or open character or hydrological, geological, historical, scientific, wildlife management, recreational or other significance or value". MGL Chapter 21, Section 7H, establishes within DFW "…a bureau of wildlife research and management…[to] provide for all beneficial forms of wildlife …[through] wildlife research and management…". Further, Chapter 131:1A places all activities carried out by DFW "...under the supervision and control of the Fisheries and Wildlife Board, which shall consist of seven members to be appointed by the Governor for terms of five years".

2. Biodiversity initiative

In support of this mandate and with the approval of the Fisheries and Wildlife Board, the Division began a biodiversity initiative in July 1996 which seeks to combine management of upland habitats by the wildlife section with restoration of unique ecological communities by the Natural Heritage section. The goal of this coordinated effort is to enhance and maintain the biological diversity of Massachusetts. From DFW's perspective, the term 'biodiversity' refers to the entire assemblage of plants and animals, their supporting habitats and natural communities, and the natural processes that sustain them. This effort involves the DFW Forestry Program (which manages forested portions of state wildlife lands), the Upland Habitat Management Program (which coordinates with DFW District offices to manage abandoned agricultural lands), and the Ecological Restoration Program (which manages degraded and/or altered habitats). The Forestry and Upland Programs are components of the DFW Wildlife Section, and the Ecological Restoration Program is a component of the DFW Natural Heritage and Endangered Species (NHESP) section.

3. Forest certification and ecoregion planning approach

This plan covers management activities conducted by the DFW Forestry Program on over 31,000 acres of state wildlife lands in DFW's Berkshire Highlands Forest Management Zone. DFW lands were certified under the international Forest Stewardship Council (FSC) criteria for sustainable forestry in May of 2004 (Seymour et al. 2004, also see http://www.fscus.org/newsletters/FSCNews_jun_2004.pdf). The FSC certification encourages ecoregion assessment and planning for public forestlands in Massachusetts, and requires that DFW complete forest management plans for all of its properties. Accordingly, DFW has worked cooperatively with other EOEA agencies (including the Department of Conservation and Recreation (DCR) Division of Forest and Parks–Bureau of Forestry, and Division of Watershed Protection–Watershed Management Section), and with the USDA Forest Service to develop ecoregion boundaries for Massachusetts (Figure 1). EOEA, DCR and DFW are preparing ecoregion assessments to be used by all state land management agencies as an initial step in the planning process (see http://www.mass.gov/envir/forest/).

4. Forest Management Zones (FMZs), Districts, and Wildlife Management Zones

Continuing with this process, DFW has identified nine ecoregion-based Forest Management Zones (FMZs) that consider multiple DFW properties in a landscape context (Fig. 2). In some cases, an FMZ represents a single ecoregion. In other cases, an FMZ groups adjacent ecoregions that have similar management issues. Although FMZ boundaries recognize ecoregion boundaries, the process of delineating FMZs incorporated historical, cultural, and socio-economic issues, as well as ecological concerns.

While each FMZ overlaps portions of one or two of the five DFW administrative Wildlife Districts,(which are based on town boundaries (Fig. 3)), geodatabase processing allows easy tracking of forest management activities by FMZ and by administrative Wildlife District. Each FMZ also overlaps one or more of the 15 DFW Wildlife Management Zones (Fig. 4). Wildlife Management Zones were established using a combination of ecological and socioeconomic factors, and are used primarily to manage regulated hunting seasons for white-tailed deer, wild turkey, black bear, and bobwhite quail. Accordingly, these boundaries follow easily followed physical features, such as major highways and rivers which provide obvious boundaries that hunters and environmental law enforcement can recognize. Again, geodatabase processing allows easy tracking of forest management activities within each FMZ by Wildlife Management Zone.

5. Forest management planning hierarchy

In the hierarchy of forest management planning on DFW lands, FMZ plans are followed by property level plans (site plans) for each wildlife management area (WMA) within the FMZ (Table 1). Site plans are brief, specific documents that relate landscape-level goals and objectives to individual properties or groups of properties. Finally, Ch. 132 Forest Cutting Plans are generated to describe harvesting in actively managed stands on an individual property (Table 1).

Table 1.The management planning process for DFW forestlands.

DOCUMENT:	DFW Forest Management Guidelines	EOEA Ecoregion Assessments	DFW Forest Management Zone Plans	DFW Site Plans	DFW Ch. 132 Forest Cutting Plans
CONTENT:	Background and general strategy for forest management on DFW lands.	Issues and opportunities for public & private forestland in one or more ecoregions.	Ecoregion-based assessment of forest resources and proposed forest monitoring and management activities to achieve desired future conditions on DFW lands.	Property level prescriptions for active and passive management sites on DFW lands.	Stand level harvest prescriptions for active management sites on individual DFW properties.
AREA COVERED:	State	Ecoregion(s)	FMZ	WMA	Harvest Area
TIME FRAME	Open-ended	Open-ended	20 years	10 years	1 year

FMZ plans are shaped by two primary documents: the appropriate EOEA Ecoregion Assessment (described above), and the DFW Guidelines for Forest Management on Wildlife Management Areas (Scanlon and others 2000). The EOEA ecoregion assessment identifies forest resource issues and opportunities that apply to all lands in one or more ecoregions, including DFW lands. The DFW Guidelines set state-wide goals for providing a range of forest conditions, age classes, and structural diversity intended to enhance and maintain the biological diversity of species, communities, and ecosystems. These Guidelines reference the state's land use history, review pertinent literature on wildlife habitat management, and consider the ecology of natural disturbance processes in order to establish landscape composition goals for DFW forestlands.

Except in the case of rare species protection, the Guidelines are not oriented toward game, non-game or single species management. They provide a state-wide background and reference for DFW forest management planning. The Guidelines recommend the designation of active and passive management areas in order to achieve landscape composition goals. Active management areas are open to sustainable harvesting of wood products to provide young forest habitat and to enhance structural habitat attributes (e.g., snags, den trees, coarse woody debris).Passive management areas will include forest reserves that will typically be closed to commercial timber harvesting in order to provide biologically mature forest habitat (generally >150 years old) and to provide control sites for evaluating the sustainability of harvesting conducted in active management areas.

II. Introduction

This FMZ plan provides a summary and assessment of forest resources on about 33,105 acres of DFW lands in the Berkshire Highlands region of Massachusetts (Figs. 5, 5A, 5B, 5C, 5D) The plan describes long-term forest monitoring and management goals for DFW lands, and identifies portions of DFW lands where active and passive management will occur over the next few decades (2005-2025). Management activities include both active and passive management, such as timber sales designed to create or enhance young forest habitat, and identification of forest reserves to establish biologically mature forest habitat.

The Berkshire Highlands FMZ consists of four ecoregions which span the two different ecological provinces in Massachusetts (Figs. 2 and 6), and is described in the recent EOEA Berkshire Ecoregion Assessment (Fleming and others 2005). A combination of ecological, socioeconomic, and administrative factors led DFW to group the Southern Green Mountains, Berkshire–Vermont Highlands, and Vermont Piedmont ecoregions in the New England–Adirondack Province, with the Berkshire Transition Association of the Hudson Highlands Ecoregion in the Eastern Broadleaf Forest (Oceanic) Province into the Berkshire Highlands FMZ (Fig. 6).

The boundary between the New England-Adirondack and Eastern Broadleaf provinces closely parallels what Cogbill et al. (2002) referred to as a "discrete tension zone" that formerly separated northern hardwood and central hardwood forests prior to European settlement. This tension zone corresponds to differences in physiography, climate, and fire regime. The ecoregions within the New England-Adirondack Province will tend to support Northern Hardwood (Beech-Birch-Maple) forest intermixed with White Pine, Eastern Hemlock, and at higher elevations, Red Spruce and Balsam Fir, while all sub-sections in the Eastern Broadleaf Province will tend to support Oak-Hickory forest intermixed with White Pine, some Eastern Hemlock, and in Eastern MA, Pitch Pine and Scrub Oak. However, the post-European settlement view of forests as commodities to be exploited led to a dramatic and drastic alteration of the forest landscape throughout Massachusetts during the 18th and 19th centuries (Foster et al. 1998). This alteration

obscured regional forest patterns like those described by Cogbill et al. (2002) that formerly corresponded to climate, substrate, and fire regime (Foster et al. 1998, Fuller et al. 1998).

Although the original pre-European settlement ecology of this region would seem to imply a different management approach for the Berkshire Transition ecoregion vs. the Southern Green Mountains, Berkshire–Vermont Highlands, and Vermont Piedmont ecoregions, the similar historical land-use throughout these four ecoregions, and the cultural connections of the entire Berkshire Highlands supports the combination these areas into a single FMZ. Geodatabase processing readily allows tracking of management activities anywhere within the Berkshire Highlands FMZ by ecoregion and/or by province.

III. Goals and Objectives

The overall goals of the Berkshire Highlands FMZ plan are to:

- Identify a desired future condition of forest resources that will conserve and enhance biological diversity on DFW lands within the FMZ.
- Plan forest monitoring and management activities that will support the desired future condition over the next 20 years.

A number of specific objectives support these goals:

- Evaluate impacts of landuse history and natural disturbance processes on forest habitat in the FMZ.
- Summarize current forest resource conditions on DFW lands in the FMZ.
- Establish forest structure and composition goals that define a desired future condition for the FMZ to conserve and enhance biological diversity.
- Identify active and passive management sites on DFW lands that facilitate achieving forest structure and composition goals. Active management sites support sustainable harvesting operations that provide young forest habitat, while passive management sites include forest reserves that are closed to commercial harvesting to serve as control sites for evaluating sustainability of harvesting and to provide biologically mature forest habitat).
- Establish biological monitoring and silvicultural prescriptions for active management sites on DFW lands that will achieve forest structure and composition goals.
- Establish biological monitoring and passive management prescriptions (e.g., invasive plant control, prescribed fire application, public recreation use) for forest reserve areas.
- Plan spatial and temporal applications of silvicultural prescriptions on active management sites.

IV. Landuse History & Natural Disturbance Processes

1. Land-use history and pre-settlement condition

The current even-age forests that dominate the Berkshire Highlands landscape are the result of historic land use practices followed by farm abandonment. The forest communities and species assemblages that now dominate our forest landscape bear little relationship to the physiographic relationships that dominated the landscape prior to the colonial era (Foster and others 1998). A period of several hundred years may be required before stable community relationships become reestablished. In fact some plant and animal communities may have been altered beyond the point

or threshold that makes the return to a natural community structure and composition difficult or even impossible (Engstrom and others 1999). The fire-adapted communities of the pre-European settlement era that likely occurred in the river valleys of the Eastern Broadleaf Forest portion of the Berkshire Highlands FMZ represent one example of natural communities that may be difficult, if not impossible to restore, at least on a large scale.

Currently, the plant communities in this FMZ are structurally and compositionally very different from those that occurred during the pre-settlement period. In the New England-Adirondack province prior to European settlement, the sides and summits of mountains were typically covered by hemlock, spruce and fir while the greater portion of the uplands was probably dominated by a mosaic of biologically mature, uneven-age northern hardwoods with a more substantial component of American beech than occurs today (Cogbill et al. 2002). Unlike the pre-settlement forest communities, the current forest communities of this ecological region contain proportionately fewer conifers. In addition, the introduction of the Hemlock Adelgid will likely remove most of the remaining hemlock cover, and further exacerbate the recent historical trend toward reduced conifer habitats throughout the Berkshire Highlands FMZ.

Hemlock was probably the most abundant conifer within the hardwood communities while white pine was scattered occasionally throughout. Most of the rest of the northern hardwood forest community consisted largely of yellow and white birch, beech and sugar maple. Ash and basswood could have been locally important in some areas and oak and chestnut likely occurred primarily on dry ridges or alluvial soils (Bromley 1935). Bromley's speculation that the predominant vegetation of pre-colonial southern New England was not a closed canopy forest, but rather was an open "woodland greatly modified by fire and anthropic factors," probably referred primarily to the Eastern Broadleaf Forest province, with its dominance of oak, chestnut, and hickory species.

Knowledge and understanding reference conditions (the pre-settlement plant community dynamic) and the natural disturbance patterns that shaped those conditions helps land managers to refine silvicultural practices to regenerate native tree species historically adapted to the site, and to emulate natural disturbance process that originally maintained a mix of native species and natural communities. Human impacts (landuse change, introduction of exotic pathogens, etc.) makes it impractical to implement management scenarios that mimic landscape conditions under pre-settlement disturbance regimes. However, it is still prudent to use the range of pre-settlement conditions to evaluate current and future management scenarios. An understanding of the background rates and causes of change in forested landscapes can help to guide conservation efforts on many scales (DeGraaf and Miller, 1996).

However, identification of reference conditions is one of the major challenges for land managers interested in emulating natural disturbance patterns. In the absence of detailed site specific information, but with evidence from the remnant plant populations as well as early recorded observations, it seems clear that harvesting in these northern hardwood plant communities during the settlement period decreased the proportion of conifers relative to hardwoods and probably increased the proportion of yellow birch, white birch, striped maple, pin cherry and aspen relative to the pre-settlement condition (Bromley 1935).

One biologically mature northern hardwood community in southern New England that was not disturbed during the settlement period was characterized in 1913 as being dominated by beech and hemlock in slightly varying amounts but totaling 55% when taken together. Sugar maple (12%), yellow birch (10%), red oak (6%), chestnut (6%), white ash and basswood (7%), black cherry, red maple, black birch and white pine (4%) were the other components of this association (Nichols 1913 and Lutz 1928, cited in Bromley 1935). Chestnut has since become an understory species due to the Chestnut blight, while sugar maple, red oak, and black cherry have been

preferentially harvested since the second half of the 20th century, often through the practice known as "high grading" (Mauri 1998).

2. Natural and anthropogenic disturbances

While biologically mature, uneven-age forests dominated the New England-Adirondack Province landscape prior to settlement, other age classes and seral stages must have also occurred in response to disturbance. Neither anthropogenic fire nor lightening-caused fires are known to have been common pre-settlement disturbances in this region. The finely compacted duff layer that is common to these northern hardwood communities does not dry quickly (Lorimer 2001) and the area is known as the asbestos forest (which is difficult to burn). However, occasional dry season fires cannot be ruled out, and can still occur today during periodic summer droughts.

Within the Eastern Broadleaf Forest Province there remains controversy surrounding the extent of oak woodlands maintained by anthropic fire, but historical and palynological evidence is consistent and suggests that fire-adapted oak woodlands areas probably occurred near Indian habitation along the coast and rivers (Patterson and Sassaman 1988) and in the uplands near major river drainages (Byers 1946). These woodlands represent biologically mature forests with a unique structure that supports early successional understory species (Rawinski 2000). Although there is not strong evidence for anthropogenic fire in the New England-Adirondack Province, research in the similar northern hardwood forests of Ontario, Canada, where burning by First Nations people continued as recently as the latter part of the 20th Century, showed that anthropic fire can dramatically change the species composition of forests (Clark and Royall 1995).

Large and small windstorms were probably the main source of disturbance in the northern hardwood and northern hardwood/conifer communities of the New England-Adirondack Province. Small windstorms that take down patches or groups of trees are now, and were probably the most common and frequent form of disturbance for this ecological region. Because large catastrophic wind events that produce large areas of young forest habitat were most likely not frequent in this ecological region, populations of animals that rely on young forest habitat may be adapted to erratic fluctuations in available habit (Lorimer 2001).

Mature forest canopies in New England have historically been disrupted by various natural disturbance events, including wind (e.g., down-bursts, tornadoes, or hurricanes), fire (e.g., lightning strikes and intentional spring fires set by native-Americans), flooding (e.g., beaver impoundments and spring floods along major rivers and streams), and pathogens (e.g., insect infestations) (see DeGraaf and Miller 1996, pp. 6-10 for review). Wind disturbances have occurred historically throughout Massachusetts, with hurricanes being more prominent in eastern Massachusetts, and down-bursts and tornadoes more prevalent in western Massachusetts. Fire was historically more common in the eastern part of the state and in the major river valleys. Beaver flooding occurred throughout the state until beaver were extirpated from nearly all of Massachusetts by 1700 (Foster et. al. 2002) (limited beaver flooding occurs today in all but the southeastern part of the state since beaver were re-established during the 20th century). Pathogens most likely had sporadic historical impact throughout the state, with insects such as the gypsy moth altering forests since the late 19th Century (Forbush 1907)

Historical return intervals for canopy-replacing wind and fire disturbance events vary across Massachusetts, and are generally shortest in the pitch pine-oak barrens of coastal and eastern Massachusetts (40-150 years between severe fires and/or hurricanes), followed by oak-hickory forests (85-380 years between fires and/or wind events), northern hardwood forest (500-1,500 years between wind events and occasional fires), and spruce-northern hardwood forest (230-545 years between wind, insect, and/or fire events) (Lorimer and White 2003). These disturbance intervals indicate that 10-31% of pitch pine-oak barrens naturally occur as young (≤15 year-old)

forest, compared to 3-40% of oak forests, 1-3% of northern hardwood forests, and 2-7% of spruce-northern hardwood forest (Lorimer and White 2003).

Patch sizes for individual wind and fire disturbances appear to range from <1 acre to a few thousand acres, with the majority of individual disturbance patches occurring toward the small end of the range. For example, it has been estimated that the majority of natural disturbance patches in original northeastern forest caused by wind, water, or pathogens commonly occurred in gaps <0.05 ac (Runkle 1982). However, while the great majority of disturbance patches are relatively small, the few large disturbance patches that do occur account for a substantial amount of all young forest (e.g., >40% of total blowdown patch area in northern hardwood forest) and likely provide important young forest habitat for wildlife species that are area-sensitive (Lorimer and White 2003).

Larger patch sizes tend to be associated with more frequent disturbance intervals, but a range of patch sizes occur across all four of the general forest types discussed here. Historically, the largest, individual wind and fire disturbance patch sizes appear to range from about 700 ha in northern hardwood forest to more than 1,000 ha in pitch pine-oak barrens in the northeast (Lorimer and White 2003). Disturbance patterns are spatially non-random, and are highly influenced by soil and topographic features and human settlement patterns (Lorimer 2001). Natural disturbances often overlap and as a result some trees never fully mature before a subsequent disturbance destroys them, while other trees can attain biological maturity if they escape natural disturbance over two or more centuries.

Young forests were extremely common in Massachusetts during the late nineteenth and early twentieth century as abandoned farmland reverted to forest cover. Today, however, only 5% of forestland in the state occurs in a young (seedling/sapling) condition (Alerich 2000). Young forest habitats are presently less common in southern New England than they were in pre-settlement times (Litvaitis 1993, DeGraaf and Miller 1996). Wind events still provide some young forest in Massachusetts today, but the impact of fire and beaver flooding on the landscape have been dramatically reduced following European settlement, fire prevention activities and land development (Askins 2001).

Fire has largely been excluded from the Massachusetts landscape for public safety reasons, and has resulted in the loss of fire-adapted, young forest habitats that formerly occurred in portions of the Eastern Broadleaf Forest Province. It is more difficult to appreciate the loss of young forest and shrubland habitat that historically resulted from beaver flooding because beaver are active on the Massachusetts landscape today, and continually cause problems for people by plugging road culverts and temporarily flooding well and leach fields in residential areas.

Given current problems caused by beaver activity, it is difficult to appreciate the diverse habitats provided by extensive beaver flowages that formerly occupied far greater areas of what is now Massachusetts during pre-settlement times. Beaver activity historically occurred most frequently on lower slopes and along low-gradient streams in Massachusetts (Howard and Larson 1985). These low-lying sites have generally been the focus of human development in Massachusetts, and humans typically exclude extensive beaver activity from developed sites.

We simply do not know the extent of historic beaver-influenced habitats. However, we do know that the Massachusetts Bay Colony in what is now southeastern Massachusetts reported shipments of over six tons of beaver pelts to Britain in the 1620's (Foster et al. 2002). While these shipments likely included some pelts trapped from inland areas, it is still sobering to consider that few or no beaver occur today in many portions of southeastern Massachusetts. Likewise, we know that during the five-year period from 1652 to 1657 fur trader John Pynchon shipped 8,992 beaver pelts from Springfield, Massachusetts in the Connecticut River drainage (Judd 1857 in DeGraaf and Miller 1996). In contrast, approximately 6,500 beaver pelts were tagged by all

licensed trappers in the entire state of Massachusetts during the five-year periods from 1985-1990, and 1990-1995 (DFW unpublished data). In pre-colonial New York State, beaver-created floodplains occurred on about one million acres, or 3.5% of the state. The extent of these floodplains is now reduced by 65% (Gotie and Jenks 1982 in Hunter et al. 2001).

Historically, as dams were abandoned after beaver food resources (primarily tree bark and twigs) became depleted, the impoundments slowly drained, and succeeded first to wet meadow, and then to shrubland and young forest as former impoundments dried more completely. After adequate woody growth become re-established, beaver typically re-occupied these low-lying sites, built a new dam, and began the dynamic process of habitat modification all over again. Because human development in Massachusetts is concentrated in low-lying areas along rivers and streams where beaver activity is largely excluded, an important source of young forest habitat formerly associated with these sites has been substantially diminished.

Further, pre-settlement forests which formerly occupied what is now developed land likely experienced more frequent natural disturbance than other lands remaining in forest use today. Development following European settlement was focused in low-lying areas along rivers and streams because waterways provided the primary means of transporting goods, and because existing Native American clearings could be readily occupied by European settlers. Forests along waterways were formerly subjected not only to periodic wind, fire, and pathogen events that also impact forests at higher elevations, but also to repeated cycles of ice-scouring and spring flooding (along rivers), or beaver flooding and abandonment (along low-gradient streams). The disproportionate abundance of young forest habitats that likely occurred in previously forested sites that are now developed for human use must be replaced today in somewhat higher elevation forests. Even-aged silvicultural practices can provide ecologically and economically sustainable young forest habitats for wildlife.

Finally, beaver impacts on forests are reduced not only within developed portions of the landscape (e.g., within cities and towns), but also adjacent to infrastructure such as roads that support development. Beaver activity is understandably restricted by humans wherever a road crosses a stream, in order to avoid damage to the road. Beaver activity is typically constrained along a reach of stream above and below the road crossing, and the potential for beaver-generated young forest is correspondingly reduced, regardless of whether or not areas up-stream and down-stream of the crossing are developed or not.

V. Current Forest Resource Conditions

1. The Berkshire Highlands FMZ

The total area of the Berkshire Highlands FMZ is just over 820,000 acres. About 85% (more than 700,000 acres) of the FMZ is forested (Table 2). About 5.1% of the FMZ is wetland according to recent Massachusetts Department of Environmental Protection (DEP) wetlands mapping, including 1.8% forested wetland, and 3.3% non-forested wetland and open water (Table 3 and Fig. 7). About 32% (260,000 acres) of the FMZ occurs as relatively contiguous, unfragmented, or 'interior' forest that is buffered from the negative impacts of human landuse activities (Fig. 8). Interior forest habitat is generally beneficial to wildlife species such as Jefferson salamander , which benefit from extensive, relatively undisturbed forestlands (Faccio 2003), and songbirds such as the Black-throated blue warbler, Cerulean warbler, and Northern parula warbler, which demonstrate higher reproductive success in larger forest areas than in smaller forest patches (Robbins et al. 1989). It may be that wildlife species that benefit from interior forest habitat are negatively impacted by predators such as house cats, raccoons, and skunks which tend to occur at higher densities where suburban development and agricultural lands occur adjacent to forest vs. where extensive forest is buffered from development or agriculture

Extensive forest habitat does not appear to be negatively impacted or fragmented by the ephemeral effects of forest cutting activities according to studies of breeding bird activity. A general pattern appears to be that predation on bird nests increases at the edge of forest fragments, but this does not happen within forested areas that contain ephemeral, internal edges that result from forest harvesting activities. Specifically, no increases in nest predation rates were found in clearcut stands of northern hardwood relative to older stands (Degraff and Angelstam 1993), and no cumulative differences in bird species richness was found across a variety of temporary forest edges between seedling, sapling-pole, large-pole, and sawtimber stands (DeGraaf 1992). Likewise, no elevation in nest predation rates were found in managed (harvested) northern hardwood forests relative to extensive, unharvested forest reserves (DeGraaf 1995). These results indicate that if land remains in forest use, the sustainable harvest of renewable wood products can support local economies, and will not fragment forest bird habitats.

Table 2. Landuse types in the Berkshire Highlands FMZ from MassGIS 1999 Landuse aerial photograph analysis.

Landuse	Acres	Percent of FMZ
Forest	706693	84.7%
Low Density Residential	29427	3.5%
Crop Land	26337	3.2%
Pasture	16752	2.0%
Non-Forested Wetland	12612	1.5%
Water	11826	1.4%
Open Land	8803	1.1%
Medium Density Residential	3958	0.5%
Powerline	3625	0.4%
Part. Recreation	2174	0.3%
Orchard	2080	0.2%
High Density Residential	1533	0.2%
Transportation	1281	0.2%
Mining	1258	0.2%
Urban Public	1137	0.1%
Commercial	1083	0.1%
Golf Course	736	0.1%
Industrial	658	0.1%
Nursery	491	0.1%
Urban Open	460	0.1%
Cemetery	358	0.0%
Waste Disposal	269	0.0%
Multi-Family Residential	169	0.0%
Transportation Facility	94	0.0%
Water-based Recreation	71	0.0%
Spect. Recreation	42	0.0%

2. DFW Lands in the Berkshire Highlands FMZ

As of May 2005, DFW owns 33,105 acres in the FMZ in 34 properties (including 25 wildlife management areas), ranging from 11 acres to over 6,500 acres (Table 4). Detailed cover type mapping is completed for 26,160 acres. About 24,265 acres (93%) of mapped DFW lands in the FMZ are forested, including about 23,431 acres of upland forest and 834 acres of forested wetland (Table 5). About 16,669 ac (69%) of this mapped DFW forestland in the FMZ qualify as interior forest habitat. Over 80% of all interior forest on DFW lands statewide occurs in this FMZ (Fig. 8). In addition, 1830's Primary Forest (Hall et al. 2002) data exists for 15,210 acres of DFW lands in the FMZ, and 5726 of these acres (38%) were forested in 1830 (Fig. 9). This map delineates areas of land that were noted and mapped as forest at the time of maximum agricultural

development in Massachusetts. These Primary Forests, although probably used as woodlots throughout the agricultural period may contain relatively undisturbed forest soils, as well as forest communities that may be less disturbed than traditional post agricultural lands. Areas delineated as Primary Forest are considered high priority areas for monitoring and conservation action. Approximately 4245 acres of DFW forestland in this FMZ may represent both interior and primary forest (Fig. 10), although the accuracy of primary forest parcels has not yet been confirmed.

Aerial photo cover type mapping has been completed on more than 80% of DFW lands in this FMZ (26,160 acres) and is summarized in Table 5. The DFW lands are 93% forested, and those forests are predominantly mid-aged, 60-90 years. Cover-type polygons mapped as forest in the Berkshire Highlands range from less than 1 acre to over 250 acres (Fig. 11), with a median size of 7 acres. The land use history of agricultural conversion and subsequent abandonment described earlier is reflected in the relatively small median polygon size as today's forest polygons often conform to former crop fields and pastures.

Table 3. Wetlands in Berkshire Highlands FMZ (based on ecoregion boundaries as of May 2004. DEP wetlands data as of Apr 2005. DFW parcel data from MassGIS Open Space as of May 2005).

	Acres	% of Total Area Mapped by DEP
Non-forested wetland		
Bog	472	0.1%
Deep Marsh	2437	0.4%
Open Water	8714	1.4%
Shallow Marsh, Meadow, or Fen	3644	0.6%
Shrub Swamp	5407	0.9%
Sub-total	20674	3.3%
Forested wetland		
Wooded Swamp, Coniferous	4065	0.7%
Wooded Swamp, Deciduous	4610	0.7%
Wooded Swamp, Mixed Trees	2653	0.4%
Sub-total	11328	1.8%
Total wetlands in mapped area	32001	5.1%
Total area mapped by DEP	622053	100%

	Acres	%
Total area in FMZ	822658	
Percent of FMZ mapped by DEP		75.6%
Total DFW Fee Ownership land in FMZ	33105	
DFW land in area mapped by DEP	17184	
Percent of DFW land mapped by DEP		51.9%

DEP has completed wetlands mapping on approximately 60% of the FMZ. Based on a combination of DEP and DFW wetland mapping, 8% of DFW lands in the Berkshire Highlands are classified as wetland, of which 3.2% are forested wetland, and 4.8% are non-forested wetland

(Table 5). Within the portion of the FMZ mapped by DEP, 5.4% is wetland, and 4.7% of DFW land in this portion of the FMZ is wetlands.

Table 4. Acreage for DFW Fee Ownership in Berkshire Highlands FMZ. DFW parcel data based on Open Space data layer as of May 2005. FMZ based on ecoregion boundaries as of May 2004.

Site Name	**Acres**
Becket WMA	219
Catamount WMA	462
Chalet WMA	6529
Cummington WMA	189
Darwin Scott Memorial Wetland	28
Day Mountain WMA	338
Deerfield River Access	14
Eugene Moran WMA	1619
Farmington River WMA	1280
Fisk Meadows WMA	597
Fox Den WMA	4237
Grace A. Robson Sanctuary	60
Green River Access Area	20
Hinsdale Flats WMA	1548
Hiram H. Fox WMA	2937
Honey Pot NHA	70
Housatonic River Access	11
John J. Kelly WMA	325
Leyden WMA	359
Lilly Pond WMA	209
Otis WMA	105
Peru WMA	4257
Poland Brook WMA	680
Powell Brook WMA	260
Satan's Kingdom WMA	1600
Savoy WMA	1226
Stafford Hill WMA	447
Tekoa Mountain WMA	1327
Unnamed	184
Walnut Hill WMA	936
Western District H.Q.	3
Westfield River Access	342
Westfield River WMA	43
Westfield WMA	243
Whately WMA	306
Williamsburg WMA	91
Total	**33105**

Table 5. Cover types of DFW-owned land in Berkshire Highlands FMZ. Upland types mapped and accuracy checked as of 2002. Wetland types mapped in some areas in 2002, in other by DEP in 2005. See Table 3. FMZ boundary based on ecoregion boundaries as of May 2004. DFW parcel data from MassGIS Open Space as of May 2005.

Cover Type	Acres	% Total
Developed upland		
Non-vegetated	14	0.1%
Developed	93	0.4%
Sub-total	107	0.4%
Non-forested upland		
Abandoned field	219	0.8%
Agricultural	26	0.1%
Abandoned orchard	1	0.0%
Grass	178	0.7%
Shrubland	92	0.4%
Sub-total	516	2.0%
Forested upland		
Central Hardwood	774	3.0%
Central Hardwood-Hemlock-White Pine	137	0.5%
Central Hardwood-White Pine	101	0.4%
Hemlock-White Pine	405	1.5%
Mixed Hardwood	582	2.2%
Mixed Hardwood-Hemlock-White Pine	657	2.5%
Mixed Hardwood-White Pine	18	0.1%
Northern Hardwood	12229	46.7%
Northern Hardwood-Hemlock-White Pine	3907	14.9%
Northern Hardwood-Softwood	556	2.1%
Northern Hardwood-Spruce-Fir	2079	7.9%
Northern Hardwood-White Pine	604	2.3%
Pitch Pine/Oak	5	0.0%
Softwood	332	1.3%
Spruce-Fir	826	3.2%
White Pine	219	0.8%
Sub-total	23431	89.6%
Non-forested wetland		
Bog	21	0.1%
Deep Marsh	260	1.0%
Open Water	29	0.1%
Shallow Marsh, Meadow, or Fen	464	1.8%
Shrub Swamp	497	1.9%
Sub-total	1272	4.9%
Forested wetland		
Wooded Swamp, Coniferous	419	1.6%
Wooded Swamp, Deciduous	224	0.9%
Wooded Swamp, Mixed Trees	190	0.7%
Sub-total	834	3.2%
Total upland	24054	92.0%
Total wetland	2106	8.0%
Total mapped area	26160	100.0%

DFW forestlands in the Berkshire Highlands are dominated by northern hardwood forests (Table 5), but also contain a diverse mixture of hardwood and softwood components. While portions of the FMZ historically supported essentially pure northern hardwood (beech-birch-maple) forest in the New England-Adirondack Province, and pure central hardwood (oak-hickory) forest in the Eastern Broadleaf Forest Province (Fig. 6), these distinct forest types have been obscured as a result of landuse history described above. Accordingly, similar portions of DFW lands in both provinces currently support northern hardwood and central hardwood forest types (Fig. 12). However, one major difference in forest types that persists despite historical land use trends: more than 20% of DFW lands in the New England-Adirondack Province retain a strong component of spruce-fir forest, while no spruce-fir occurs on DFW lands in the Eastern Broadleaf Forest Province (Fig. 12). Other forest types occur, but account for 1% or less of the DFW properties mapped in the New England-Adirondack portion of the FMZ. These types include: Central Hardwood-White Pine, Central Hardwood-Hemlock-White Pine, Pitch Pine/Oak, and Mixed Hardwood-White Pine, and in the Eastern Broadleaf province Central Hardwood-Hemlock-White Pine.

3. Uncommon natural communities

The Natural Heritage and Endangered Species Program (NHESP) has produced a draft Classification of the Natural Communities of Massachusetts (Swain and Kearsley 2001). Several of the communities identified as uncommon in this draft occur in the ecoregions of the Berkshire Highlands FMZ. Uncommon natural communities associated with the New England-Adirondack Province include Rich Mesic Woodlands, Spruce-Fir Boreal Swamp, and Spruce-Tamarack Bog. In the Eastern Broadleaf Province portion of this FMZ, uncommon communities may include Yellow Oak Dry Calcareous Forest, Hickory-Hop Hornbeam Forest/Woodland, Black Gum Swamp, and fire-maintained oak woodlands/savannahs (not currently recognized by the NHESP draft classification). Our objective is to maintain or enhance these communities where they occur, however, records on occurrence of these uncommon natural communities are incomplete.

Of the eight communities listed above, Rich Mesic Woodland is the community that is most likely to be impacted by timber harvest operations because this community can potentially support high quality/high value northern hardwood timber products (e.g., white ash, sugar maple). For example, non-native invasive plants may be carried into and become established within these communities during harvesting, and invasive plants can displace rare native herbs associated with Rich Mesic forest.. More directly, a change in light levels or moisture regimes may negatively impact rare native plant assemblages. Even timber harvests that occur outside of a Rich Mesic community can impact these unique sites if water and nutrient flow into the community is disrupted by rutting up slope of the community. The occurrence of Rich Mesic Woodlands and other priority natural communities are documented during forest inventory activities and mapped with GPS techniques. Accordingly, DFW recently began a comprehensive effort to identify and map all Rich Mesic Woodlands sites on state wildlife lands in the Berkshire Highlands FMZ so that unique attributes of these sites can be conserved during timber harvest operations.

Existing NHESP records document 20 polygon occurrences of rich mesic forest totaling 597.9 acres on DFW lands in the Berkshire Highlands FMZ (NHESP Unpublished Data). During the winter of 2004-2005, the DFW Forestry Program worked cooperatively with the University of Massachusetts Cooperative Extension Service in Amherst, and with NHESP to identify additional, potential rich mesic forest sites on DFW lands. Knowledge of existing rich mesic sites was coupled with attributes such as slope, aspect, landform, bedrock geology, and documented occurrences of rare plant species associated with this community (e.g. Goldie's Fern (*Dryopteris goldiana*), Hairy Wood-mint (*Blephilia hirsuta*), Broad Waterleaf (*Hydrophyllum canadense*), Woodland Millet (*Milium effusum*), and Hitchcock's Sedge (*Carex hitchcockiana*).

A total of 64 polygons representing 3091.5 acres of potential rich mesic forest were identified on DFW lands in the Berkshire Highlands. Of these 64 polygons, 6 were located on land where DFW holds only a conservation restriction, and these six polygons were not visited. The 58 remaining polygons represent 2802.9 acres. During the spring of 2005, 44 (69%) of these polygons were visited by field staff, and 24 (55%) were found to support at least some rich mesic forest. Additional GIS analysis is underway on DFW lands in the Berkshire Highlands to estimate the number of acres delineated by this field effort. During the process of this field work, 16 additional rich mesic sites were identified outside of the potential rich mesic forest polygons.

A complete floristic inventory was conducted at each of these sites using a modified Natural Heritage "Form3" sample (typically a 15 x 15 m sample plot). Herbaceous and woody plant species typically observed at these newly documented rich mesic forest sites include Sugar Maple (*Acer saccharum*), Basswood (*Tilia americana*), Hophornbeam (*Ostrya virginiana*), Wild Leek (*Allium tricoccum*), Broad-leaved Toothwort (*Dentaria diphylla*), Maidenhair fern (*Adiantum pedatum)*, Blue Cohosh (*Caulophyllum thalictroides*), Glade Fern (*Diplazium pycnocarpon*), and Plantain-leaf Sedge (Carex plantaginea), among many other plant species. Observations included new element occurrences of rare plants. Any forest harvesting operations that may occur near documented rich mesic forest sites will be designed to conserve these communities.

4. Forest inventory status

A comprehensive forest inventory is currently underway to refine timber volume and growth estimates for DFW lands in this FMZ, and to document species occurrence and abundance of forest herbs and shrubs. To date, inventory has been completed on about 6,622 acres, or 28% of the 23,431 acres of DFW upland forest in the FMZ. Initial analysis of this inventory data indicates that there is approximately 3.9 MBF of merchantable timber, 11 cords of firewood, 5 cords of softwood pulp, and 4 cords of cull and standing snags per acre averaged across all upland forest types in the FMZ. These initial results are expanded to estimate current wood volumes on all DFW lands in the Berkshire Highlands FMZ in Table 6. The 3.9 MBF/acre of sawtimber on DFW lands in this FMZ appear to be substantially lower than the 6.2 MBF/acre reported for all Massachusetts forestlands (Alerich 2000) and is likely due to cutting of high value timber trees on many parcels immediately prior to state acquisition.

The wood products volume estimates derived from the initial results of the DFW forest inventory (Table 6) are consistent with the forest cover types described above (Table 5) in that northern hardwood tree species are dominant, with a notable inclusion of native spruce forest. The forest inventory for the DFW Berkshire Highlands FMZ is scheduled to be completed by the end of 2006.

VI. Forest Structure and Composition Goals

1. Biodiversity and forest habitat conditions

Preserving biodiversity in temperate forest requires the maintenance of all successional stages (Franklin 1988), and managers should recognize the role of disturbance in maintaining biodiversity (DeGraaf and Miller 1996). Forest managers need to provide a range of habitats at temporal and spatial scales that will support viable populations of all native wildlife species, and this task must be accomplished in a landscape that is being increasingly developed for human use, and that does not resemble any previous historical condition. While it is instructive to examine the historical range of variability associated with natural disturbance regimes (see DeGraaf and Miller 1996, Thompson and DeGraaf 2001), managers should not seek to re-establish conditions from a previous time (e.g., prior to European settlement), but rather should seek to secure a range

of conditions in today's landscape that will support viable populations of native wildlife species (DeGraaf and Yamasaki 2003).

Table 6. Estimated volume of merchantable timber, firewood, pulpwood, cull, and standing snags on 23,431 acres of DFW upland forest in Berkshire Highlands FMZ, based on 169 inventory plots as of 9/15/2005. FMZ boundary based on ecoregion boundaries as of May 2004. DFW parcel data from MassGIS Open Space as of May 2005.

Tree Species	MBF	1,000 Cords
Red Maple Sawtimber	15,000	
Sugar Maple Sawtimber	14,930	
White Ash Sawtimber	10,750	
Black Cherry Sawtimber	9,700	
Red Oak Sawtimber	3,020	
Black Birch Sawtimber	1,900	
Aspen Sawtimber	1,780	
American Beech Sawtimber	1,370	
White Birch Sawtimber	920	
Other Hardwoods	225	
Red/Whiter Spruce Sawtimber	14,160	
Hemlock Sawtimber	6,170	
White Pine Sawtimber	4,330	
Balsam Fir Sawtimber	1,640	
Norway Spruce	530	
Total Sawtimber	91,795	
Firewood		260
Softwood Pulp		120
Cull		30
Snags		70
Total Cords		**480**

Following any disturbance to a forest canopy, the flush of woody and herbaceous vegetation on the forest floor provides food (e.g., berries, browse, and insects) and cover (e.g., shrubs, tree seedlings, and slash) resources for wildlife that is generally lacking in older forest. Wildlife species that prefer young forest conditions have been perceived as habitat generalists (see Foster and Motzkin 2003), but in fact, many wildlife species associated with young forests are habitat specialists with specific vegetation structure or area requirements, such as the New England

cottontail and chestnut-sided warbler (DeGraaf and Yamasaki 2003). Relatively large (>25 acre) patches of young forest habitat may be necessary to maintain viable populations of mammals associated with young forest (Litvaitis 2001). In addition, Hunter et al. (2001) note that young forest conditions are important for wildlife species generally associated with mature forests. Examples include fledgling and molting adult wood thrushes (Hylocichla mustelina) that move from mature forest to patches of young forest habitat that may provide critical for food and cover resources not typically found near nesting sites.

Young forest communities established by clearcutting can temporarily reduce amphibian numbers (Pough et al. 1987), including the terrestrial-breeding redback salamander (Plethodon cinereus) (DeGraaf and Yamasaki 1992 and 2002), the wetland-breeding wood frog (Rana sylvatica), and mole salamanders (Ambystoma spp.) (deMaynadier and Hunter 1998), which require a moist environment and are not especially mobile. However, a shaded canopy is usually restored within 10 years, redback salamander numbers typically recover to pre-cut levels within 30 years (DeGraaf and Yamasaki 2002), and there is generally no difference in numbers of salamanders in 60-year old second growth forest vs. old growth forest (Pough et al. 1987). Maintaining sustainable populations of amphibians can be compatible with timber harvesting (deMaynadier and Hunter 1995, Brooks 1999).

Throughout the Berkshire Highlands FMZ, only a minority of forest area occurs in a young forest condition at any given point in time, so the many habitat benefits of young forest can be realized without any substantial threat to populations of mature forest species. Overall, young forests support a great diversity of wildlife species and are a critical component of wildlife habitat at the landscape level (DeGraaf and Yamasaki 2001, 2003).

Vertebrate wildlife species in New England benefit when primarily forested landscapes contain a mix of forest size classes, generally 5-15% seedling (or young forest), 30-40% sapling-pole, 40-50% sawtimber, and <10% large sawtimber (DeGraaf et al. 1992, DeGraaf and Yamasaki 2001). In addition to these development stages, the establishment of biologically mature forest habitat conditions addresses the Divisions' biodiversity goals because older forest habitat will likely support and benefit a wide variety of invertebrate wildlife species and understory plant assemblages. It may be desirable to maintain 10% or more of forest landscape in a biologically mature forest condition (Vora 1994).

Seedling forest is defined here as areas >1 acre, and preferably >5 acres where >75% of the site is dominated by tree regeneration <1" dbh. While a variety of wildlife species will utilize patches of young forest habitat <1 acre in size (e.g., white-tailed deer) other species tend to rely on larger patches of regeneration that supply abundant food and cover resources (e.g., Golden-winged warbler, Mourning Warbler, Ruffed Grouse, New England Cottontail).

Biologically mature forest is defined as having attained >50% of its maximum expected biological age – generally >150 years for the range of tree species native to Massachusetts. Biologically mature forest is uncommon throughout New England because trees generally reach economic maturity long before they reach biological maturity (60-90 years, vs. >150 years, respectively). To approximate a natural landscape age structure in New England, a portion of forest area should reach 300 years of age (Seymour and Hunter 1999).

2. Landscape composition goals

Establishing landscape composition goals is an inexact science, but it is prudent to determine a desired future condition for WMA forestlands based on available knowledge. After considering habitat requirements for both vertebrate and invertebrate wildlife, landscape composition goals for WMA forestlands statewide presently include 5-10% young (seedling stage) forest, 10-15% sapling/small pole forest, 35-40% large pole forest, 35-40% sawtimber forest, and 10-15%

biologically mature forest (Fig. 13). Due to the different historical natural disturbance patterns and resulting forest age composition in the forests of the New England-Adirondack Province and the Eastern Broadleaf Forest Province (i.e., more frequent and larger disturbances in the Eastern Broadleaf Forest Province produce more young forest and less mature, undisturbed forest relative to the New England Adirondack Province), DFW will likely manage toward the low end of the composition goal for young forest habitat and toward the high end of late-seral habitat in the New England-Adirondack Province, and toward the high end of the composition goal for young forest habitat and toward the low end of biologically mature forest habitat in the Eastern Broadleaf Forest Province (Fig. 6)

The focus of management on DFW forestlands in the Berkshire Highlands FMZ is the modification of forest age class composition through active management to create more young forest habitat,, and passive management to establish more old forest habitat. DFW seeks to double median stand size from the current seven acres on actively managed sites by combining small, adjacent, relatively homogeneous stands that reflect post-agriculture landscape patterns into larger, more heterogeneous stands defined by landform. While small forest patches can provide viable habitat for many wildlife species, and while several small forest patches may have greater bird species richness than a single large patch, certain species are never found in small patches (Askins et al. 1987, Robbins et al. 1989).

DFW will seek to locate and conserve uncommon natural communities such as rich mesic forest that are tracked by the Natural Heritage and Endangered Species Program (see: http://www.mass.gov/dfwele/dfw/nhesp/nhcommun.htm). DFW will also seek to maintain and increase the diversity of tree species on harvested sites, and will favor regeneration of species which are being preferentially harvested and/or not commonly regenerated elsewhere in the FMZ. These efforts should provide a range of habitats for flora and fauna that enhance natural community, species, and genetic diversity within this landscape.

In the New England-Adirondack Province, tree species that are not being commonly regenerated include red spruce, black cherry, yellow birch, and other species that require large gaps or small clearcuts to provide adequate sunlight for regeneration. In the Eastern Broadleaf Province, these species include oaks (especially northern red oak), and the more southern species such as hickory. Where adequate seed trees of these species exist, our objective in actively managed areas will be to regenerate as many different species as possible, with preference given to those that are underrepresented in the landscape relative to the inferred reference conditions. In both provinces, plantations of non-native tree species will be removed to regenerate plant communities that contain a diversity of native species. Successional ("old-field") white pine will be harvested to establish mixed stands of native species.

In addition to modifying forest age class composition and tree species composition as described above, DFW also seeks to increase diversity of forest stand structure irrespective of age class or species composition by retaining large trees in all stands that will eventually become snags, then coarse woody debris, and that may produce tip-up mounds when felled by a wind disturbance event. Overall, silvicultural practices on actively and passively managed forestlands will create extensive, heterogeneous forest patches with characteristics of unmanaged forest landscapes.

In summary, forestland managers interested in maintaining and enhancing biodiversity within the Commonwealth's predominantly mature, even-age forest landscape face distinct challenges.

- Establish and maintain adequate young forest habitat to support declining populations of native wildlife species associated with these habitats (DeGraaf and Yamasaki 2001).
- Design and conserve areas of extensive biologically mature forests with late-seral species (passive management only) (Askins and others 1987, Litvaitis 1993).

- Increase stand size, diversify species composition, and enhance structural attributes in the relatively small and homogeneous post-agricultural forest stands that presently dominate the landscape in favor of larger and more heterogeneous stands defined by landform.
- Develop management prescriptions that are based upon decisions made with landscape scale information about current resource conditions relative to future desired condition(s).

3. Desired future condition

Accordingly, the desired future condition for DFW forestlands in the Berkshire Highlands FMZ is best represented by:

- Relatively large (e.g., 10-100 acres) forest stands typically defined by landform and containing a diversity of native tree, shrub, and herb species, as well as a diversity of structural attributes such as snags, den trees, tip-up mounds, and coarse woody debris.
- A compositionally and structurally diverse forest landscape that contains both young forest as well as mature forest elements.

Because more than 80% of Massachusetts' commercial forests are owned by the private sector, the challenge to establish and maintain adequate biologically mature forest habitat at the landscape level can most realistically be met by cooperation between public land managers, private forestland owners, land trusts and other private non-profit groups who are willing to work across property and political boundaries at the landscape level. While DFW forest lands and some private non-profit lands can forgo some short term economic return in order to focus primarily on conservation and enhancement of biological diversity, private forestland owners typically need to generate more income to pay property taxes and offset increasing development pressure. This economic reality can make it difficult for private forestland owners to forgo timber income in order to accrue biologically mature forest habitat. Goals for biologically mature forest habitat will most likely to be realized on some combination of public lands, private non-profit lands, and other private lands where landowners are willing to forgo timber income, or have been compensated for lost income through some type of conservation restriction.

On DFW lands, the production of timber products is seen as an additional benefit of forest habitat management. Timber harvests must be consistent with achieving the landscape forest composition objectives described above. Where landscape composition goals have been met, harvests of timber products within a FMZ will not exceed the estimated growth in timber volume for that FMZ. Even where landscape goals require the creation of more young forest habitat than currently exists in a FMZ, harvests of timber products on DFW lands will typically not exceed estimated volume growth.

VII. Active and Passive Management (Land Use Zoning)

The vast majority (>99%) of DFW lands are loosely zoned for either active or passive management. Parking areas and river/pond access sites (<1%) support intensive use but are managed by the DFW District Offices and/or the Massachusetts Public Access Board. Active management sites are open to commercial harvesting of wood products to provide young forest habitat, and to non-commercial cutting and clearing of abandoned agricultural sites to provide open shrubland and grassland habitats for native wildlife species experiencing long-term population declines (abandoned agricultural sites are managed by the DFW Upland Habitat Program in coordination with the DFW Forestry Program). Passive management sites typically do not support commercial harvesting and primarily include wetlands and forest reserves that provide biologically mature forest habitat. Both active and passive management sites are

monitored and treated to control invasive, exotic species, and to apply prescribed burning in fire-adapted natural community types.

The planned sustainable harvest of renewable wood products from active management sites will provide a range of forest age classes across the landscape and help to conserve biological diversity while supporting local economies that manufacture wood products used by all residents of the Commonwealth. At the same time, forest reserves will provide important baseline data on forest structure and composition that result primarily from natural disturbance process. Reserves are a component of primarily forested landscapes where the great majority of land is open to commercial harvesting of renewable wood products, and are discussed in more detail below.

1. Passive management and forest reserves

Both reserves and harvested lands contribute to conservation of biological diversity, so why are reserves needed? Reserves provide "control" areas for comparison to "treatments" applied to harvested sites. The species and communities that occupy reserves over time can be compared to species and communities on harvested sites to verify that forestry practices on DFW lands sustain all components of biological diversity. Forest reserves provide unique recreational and aesthetic opportunities, and based on initial public comments can potentially serve as a spiritual resource for residents of the Commonwealth. Forest reserves provide potential refugia for unique species assemblages, and may provide habitat for invertebrate wildlife and soil micro-organisms that have not been well studied to date.

The wood products harvested from public and private lands support rural economies, and revenues generated from harvesting on private forestlands are essential for making it economically viable to retain private forest land in forest use. Reserves allow us to assess and to verify the sustainability of harvesting on public and private forestlands. DFW maintains that harvesting and reserves are important elements of natural resource conservation, and has established the following goals, objectives and benefits of reserves on state wildlife lands.

Goal of Forest Reserves: Provide ecological reference conditions for the diversity of forest ecosystems that occur in Massachusetts.

Objectives:

- **To the greatest degree possible, allow natural disturbance processes to determine the structure and composition of the forest ecosystem.**
- **Facilitate biological monitoring to establish baseline data on the species and communities that occupy forest ecosystems reserved from commercial timber harvesting.**

Benefits:

- **Facilitate assessment of the ecological sustainability of commercial harvesting on active management sites.**
- **Provide unique recreational and aesthetic opportunities in biologically mature forest habitats that will develop over time in reserves.**

An ecological reference condition is established when natural disturbance processes, to the greatest degree possible, determine the structure and composition of a forest ecosystem. While no forestland in Massachusetts is free of human impact from ubiquitous influences such as air pollution and invasive, exotic organisms, forest reserves can still help ensure that representative examples of biodiversity indigenous to an area are more likely to be conserved. Forest reserves provide reference sites for objective assessment of the sustainability of forest management practices (Norton 1999), and are essential for practicing adaptive resource management (Walters and Holling 1990). Reserves create opportunities for connectivity within the landscape,

conservation of species and processes, buffering against future uncertainty, and other hard to measure but valuable functions (Hunter 1996).

If reserves are to be established, how large should they be, and how many should there be? Given that a primary goal of reserves is to understand how natural disturbance processes shape the structure and composition of forest ecosystems, it seems appropriate to have some reserves that are equal or greater in size than the largest expected natural disturbance patch. Natural disturbances are common in southern New England forests, and ranges from frequent, small disturbances (e.g., annual wind events that disrupt <1 acre of forest canopy) to occasional, catastrophic disturbances (e.g. major windstorms that disrupt as much as 5,000 contiguous acres of forest canopy once every few centuries) (Table 7).

DFW supports having some large reserves of ≥5,000 acres that represent the diversity of forest ecosystems that occur in Massachusetts. The Nature Conservancy (TNC) has conducted extensive research on reserve design, and has proposed that reserves of ≥15,000 acres be established to insure that a portion of the reserve will likely occur in as biologically mature forest at all times, while other portions will likely be recovering from recent disturbances throughout time.

	Tornado	Hurricane	Down-Bursts	Large Fires	Insect Outbreak	Ice Storms	Flood
Maximum Size of Severe Damage Patch (acres)	**5,000**	**803**	**3,400**	**57-150**	**?**	**<5**	**?**
Return Interval (years)	**100-300**	**60-200**	**?**	**400-6,000**	**10**	**2**	**20-100**

Table 7. Comparison of characteristics among infrequent catastrophic disturbances in the Northern Appalachian Ecoregion (adapted from Foster et al. (1998a) by Anderson and Bernstein (2003)).

In order to plan active management, it is prudent to identify passively managed reserve sites first. DFW has participated in an EOEA effort to identify potential large forest reserves on state-owned lands throughout Massachusetts. This effort is described below, and is followed by a discussion of potential reserve sites on DFW lands within the Berkshire Highlands FMZ.

The EOEA effort is based on a fundamental assumption that reserves should occur in relatively unfragmented forest landscapes where they can be buffered from impacts of human development by working forestlands outside the reserve. EOEA began by considering 23 “matrix” forest blocks identified by the Nature Conservancy that represent the least fragmented forest landscapes remaining within Massachusetts (twenty-one in Central and Western MA, and two in Southeastern MA). A GIS analysis was conducted to identify a ≥15,000 ac portion of each matrix block that contained the largest patches of interior forest habitat and that contained the lowest density of roads and transmission lines. This analysis identified 23 sites representing eight different types of forest ecosystems (see: http://www.mass.gov/envir/forest/).

EOEA then worked with an expert panel to identify and weight eleven ecological attributes that were thought to be desirable within reserves in order to capture the full diversity of forest ecosystems, and these 11 weighted attributes were then used to rank the 23 potential reserve sites EOEA then selected eight sites from among the top half of all sites that represented the range of forest conditions found in Massachusetts (see: http://www.mass.gov/envir/forest/). Four of these eight sites occur within the Berkshire Highlands, and potentially contain 10,640 acres of DW lands (Table 8 and Fig. 14). Of the 10,640 potential reserve acres, about 10,459 acres (98.3%) are forested (10,310 acres of upland forest and 149 acres of wetland forest), and about 181 acres 1.7% are non-forested wetland

Table 8. Potential large reserve sites on DFW lands in the Berkshire Highlands FMZ.

Potential Reserve Site	DFW Property	DFW Acres
Chalet	Chalet, Stafford Hill, & Eugene Moran WMAs	7,500
Middlefield-Peru	Maple Hill & Peru WMAs	1,200
Otis	Farmington River & Otis WMAs	950
Westhampton	Hiram Fox WMA	990
Total		**10,640**

While the DFW goal for biologically mature forest habitat is 10-15% statewide, large reserves are most likely to occur in relatively unfragmented forest landscapes. The Berkshire Highlands FMZ contains more unfragmented forest (i.e., interior forest) than any other FMZ, and will likely contain the majority of total DFW reserve acreage statewide, and thus a disproportionate amount of forest reserve relative to other FMZs in the state. It is likely that little DFW reserve acreage will occur in other FMZs. Under the current proposed format for reserves, 32% (10,640 of 33,105 acres) of DFW lands within the Berkshire Highlands could potentially become reserve, but total DFW land in reserves will not exceed 15% state-wide.

DFW seeks pubic comment regarding potential reserve sites. The DFW Forestry Program will consider public comment, and will evaluate how potential reserve sites fit with existing DFW forest composition goals. Ultimately, the DFW Forestry Program Leader will recommend specific reserve sites and acreages on DFW land to the State Fisheries & Wildlife Board. The Board ultimately makes all policy decisions relative to DFW lands.

The following activities will typically be allowed or excluded from reserves as indicated:

- Regulated hunting, fishing and trapping will be allowed.
- Passive recreation including wildlife observation, hiking, and non-motorized mountain biking will be allowed.
- Motorized vehicles will be excluded. Exceptions include snowmobile use under a Special Use Permit issued by the District Wildlife Manager for designated trails.
- Biological monitoring of species and communities will be conducted.
- Commercial harvesting will typically be excluded.
- Control of invasive, exotic species will be allowed and encouraged.
- Prescribed burning will be applied in fire-adapted natural communities.

In addition to the activities described above, standard Wildlife Management Area Regulations shall apply on both active and passive management sites (Table 9).

Table 9. Wildlife Management Area Regulations

DFW holds 27 Wildlife Management Areas (WMA) and 4 River Access Areas (Deerfield, Green, Housatonic and Westfield), the Grace A. Robson wildlife sanctuary, and 5 other areas (Darwin Scott Memorial Wetland, Honey Pot Natural Heritage Area, Western District Headquarters, and 2 recent unnamed acquisitions) in the Berkshire Highlands FMZ. All WMAs and access areas are open to hunting, fishing, trapping and other outdoor recreation activities. Sanctuaries are more restrictive. Sanctuary booklets are available only from the ***MassWildlife*** Field Headquarters Office in Westborough

- No person shall possess any alcoholic beverage except under permit or dump or discard any can, bottle or rubbish.
- No person shall remove vegetation, soil or stones from any WMA except under permit.
- No person shall use excessive speed in driving a vehicle.
- No person, unless under permit, shall drive or possess any vehicle except on roads or trails maintained for public traffic.
- No person shall deface or tamper with any sign, building or equipment.
- No person shall build or maintain a fire without written permission from the Director of the Division of Fisheries and Wildlife (MDFW) or his designee.
- No person shall camp within any WMA without written permission from the Director of the MDFW or his designee.
- No person shall engage in target practicing without written permission from the Director of the MDFW or his designee.
- No person shall use any means other than shotgun or bow and arrow during the pheasant and quail season on areas stocked with pheasant or quail except for hunting raccoons between 9PM and 3AM.
- No person shall hunt on any WMA where pheasant or quail are stocked before sunrise or after sunset during the open season on pheasant or quail, except for the hunting of raccoons between 9PM and 3AM.
- No person shall hunt during the pheasant or quail season on wildlife management areas where pheasant or quail are stocked without wearing a "hunter orange" cap or hat except while night hunting for raccoons or while hunting from a blind or boat.
- No person, except under permit, shall dig or disturb any artifact or archaeological remains.

The Director may make special regulations to handle special situations peculiar to any WMA. Controlled hunts are in effect at certain times on Burns, Delaney and Ludlow WMAs. Contact District Supervisor for details.

****

Any landowner permitting use of his property for recreation without charging a fee is not liable for injuries to recreational users or their property except in cases of willful, wanton or reckless conduct by the owner (see Chapter 21, Section 17C MGL).

2. Active management sites

DFW will devote 15,400 acres of forestland in the Berkshire Highlands FMZ to even-aged silviculture, and will likely devote about 5,000 acres to uneven-aged silviculture. In addition, DFW will devote all 516 acres of non-forest uplands (Table 5) to active management of grassland, shrubland, and agricultural habitats.

DFW anticipates a 100-year rotation for even-aged silviculture, and assumes an average duration of about ten years for seedling forest. In order to reach and maintain the landscape composition goal of 5% seedling forest habitat in the Berkshire Highlands, 150 acres should be regenerated annually on DFW lands using even-aged silviculture (5% of 30,763 forested acres =1,538 acres of seedling forest/10 years duration = 154 acres/year, and 154 acres/year over a 100 year rotation = 15,400 total acres).

DFW typically applies either shelterwood with reserve cuts (where 30-50% of the canopy is removed in each of two cuts spaced 5-10 years apart, and where about 10% of the original canopy is retained [reserved] through the next rotation), or aggregate retention cuts (where 80-90% of the canopy is harvested in a single cut, and where 10-20% of the canopy is retained through the next rotation) to regenerate young forest habitat. Shelterwood cuts are typically applied to regenerate tree species such as red oak and white pine, while aggregate retention cuts are typically applied to regenerate tree species such as white birch, black cherry, and white ash.

In addition to regenerating 154 acres/year through even-aged silviculture within the FMZ, DFW could potentially thin an additional 154 acres/year when even-aged stands reach about 50 years of age (half their rotation age). DFW anticipates that these operations would be merchantable thinnings of hardwood firewood and/or softwood pulpwood that would diversify stand structure and favor crown development of individual mast-producing trees (i.e., red oak, white oak, black cherry, American beech).

With 15,400 acres of DFW forestland devoted to even-aged silviculture, and about 10,000 acres of DFW forestland potentially in reserves, the remaining 5,763 acres of DFW forestland would be potentially available for uneven-aged silviculture. DFW has not applied uneven-aged silviculture to date, but anticipates using group selection cutting in forest stands regenerated with uneven-aged silviculture, with group size ranging from 0.25-0.75 acres depending on the shade tolerance of tree species desired for regeneration (smaller patches will be used to regenerate shade tolerant species such as Sugar Maple, American Beech, and Eastern Hemlock, while larger patches will be used to regenerate more shade intolerant species such as Black Cherry and White Ash). DFW anticipates a 120-year cutting period defined by a 30-year cutting cycle where 25% of the stand is cut during each entry.

A recent GIS analysis of DFW lands in the Berkshire Highlands identified sites for potential harvesting operations over the next few decades by selecting stands of successional white pine on sites that would typically support hardwood forest communities, or mixed white pine-hardwood communities, and by selecting stands that may have been hi-graded prior to public acquisition (i.e., stands of large pole and/or sawtimber trees with open canopies and evidence of recent harvesting). This analysis identified 1,787 acres in 132 polygons on 13 properties for potential harvesting operations (Fig. 15). The majority of these sites occur on the Fox Den, Peru, Hiram Fox, and Savoy WMAs (Figs. 5 and 15) These sites are being visited by DFW staff to evaluate and prioritize sites for even-aged and uneven-aged silviculture. By the end of 2005, DFW anticipates identifying active management sites that will be harvested over the next decade.

Due to relatively low staffing levels at DFW (one management forester per >50,000 acres of state wildlife lands), timber harvests have been modest both statewide and within the Berkshire Highlands FMZ. Over the past twenty years (1985-2005), 820 acres were treated through twelve

timber sales on DFW land in the Berkshire Highlands, including portions of the Hiram Fox, Fox Den, and Chalet WMAs. A total of 2.3 million board feet of timber and 3,200 cords of firewood were harvested on these twelve sales (average harvest volumes of 2.8 MBF/acre and 3.9 cords/acre). These harvests were all first or second cut shelterwood operations in 60-80 year old stands, and were designed to regenerate young, seedling stage forest habitat. To date, DFW has not conducted any thinning operations in younger (e.g., 40-50 year old stands), but seeks to apply thinning operations at about 50% of rotation age in even-aged stands in order to diversify habitat structure and enhance mast production as described above.

The DFW Upland Habitat Program has reclaimed more than 240 acres of abandoned agricultural habitats in the Berkshire Highlands FMZ over the past eight years, including 160 acres on DFW lands at the Moran, Poland Brook, and Leyden WMAs.

Forest harvesting and Upland Program operations on DFW lands are carried out by private vendors through a public, competitive bidding process. All forest harvest operations follow a standard internal DFW procedure (Table 10).

3. Biological Monitoring

All DFW upland forestland are currently being inventoried to determine timber volume, condition, and growth rate, as well as forest community composition. Sampling is being conducted on a 10 x 40 chain grid (one sample plot for every 40 acres) and consists of tree sampling at each sample point to facilitate allowable harvest calculations, and Natural Heritage Form 3 sampling in each stand to document herb and shrub species composition, as well as vegetation structure and volume of coarse woody debris.

In addition to this comprehensive inventory, individual harvest sites are monitored for plant species composition prior to and after harvest activities so that harvest goals for regeneration of particular tree species and structural habitat conditions can be assessed. Pre- and post-harvest monitoring emphasize location of both rare and invasive plant species. Monitoring is conducted by DFW Forestry Program staff and/or qualified ecologists hired as temporary vendors. Following completion of the comprehensive inventory on any forest reserve sites, periodic re-inventory will be essential to document forest structure and composition. At present, DFW anticipates re-visiting sample locations in reserves once every ten years.

4. Environmental Permitting:

All forest management on DFW and other state-owned lands in Massachusetts is subject to a variety of Federal and Massachusetts laws and regulations. Many of these regulations are focused on preventing damage to water and wetland resources, while others protect endangered species and cultural resources, or prevent accidental fire damage (Appendix I (from Berkshire Ecoregions Assessment at: http://www.state.ma.us/envir/forest/)). The full text of Massachusetts General Laws is available at *www.state.ma.us/legis/legis.htm*).

In particular, all DFW timber sales comply with permit requirements of the Massachusetts General Law (MGL) Chapter 132, The Forest Cutting Practices Act, and specific components of MGL Chapter 131, The Wetlands Protection Act which requires Forest Cutting Plan review by the Massachusetts Natural Heritage& Endangered Species Section staff for any forest harvest operation that coincides with estimated or priority habitat for rare species. All DFW timber sales that do not fall within estimated or priority habitats are voluntarily submitted to Natural Heritage for review of potential element occurrences (EO's) of rare species that are not reflected in the estimated or priority data layers. Mitigation practices that are recommended by Natural Heritage to conserve rare species are implemented

Table 10.Checklist of procedures for conducting timber sales on DFW forestlands.

- Contact appropriate DFW District Manager to coordinate on timber sale administration.
- Review landcover mapping information (including forest stand condition, wetland location and composition, vernal pool locations, and occurrence of priority natural communities),boundary and road infrastructure condition, Natural Heritage Atlas information, and forest inventory data for the site.
- Conduct initial site visit to locate rare and/or invasive species, locate wetlands, vernal pools and seeps, and to initiate infrastructure planning for skid roads, landing locations, stream crossing, and harvest area extent. Record GPS waypoints at all appropriate points.
- Contact Natural Heritage if any portion of site occurs in Priority Habitat for recommended mitigation, and if no Priority Habitat request information on any Element Occurrences of rare species on the site and recommended mitigation.
- Compose draft site plan for the timber sale area. Include Property Summary (Site name, town(s),FMZ, Wildlife District, Ecoregion, Watershed, stands to be treated, and acres to be treated), access summary, environmental permitting, forest certification considerations, management goals, property description and history, landscape setting, disturbance history (e.g., evidence of wind or pathogen disturbance, excessive browsing by white-tailed deer and/or moose, etc.)., biological monitoring, rare species concerns, soil & water quality, historical and cultural resources, recreation & aesthetics, silviculture and references.
- Submit draft site plan to District and NHESP for review and comment. Incorporate comments.
- Establish access roads, skid trails, and landing areas according to specifications in the BMP manual.
- Establish buffer strips along roads, and filter strips along riparian areas as per the BMP manual.
- Avoid wetland resource area crossings when planning skid trails and access roads whenever possible. Establish and maintain necessary stream and wetland crossings for logging machinery as indicated in the Massachusetts Forest Best Management Practices Manual (the BMP manual) (Kittredge and Parker 1995).
- Plan harvest near vernal pools according to guidelines for certified vernal pools in the BMP manual.
- Plan harvest near seeps according to guidelines by Healy and Casalena (1996).
- Review site plan with DFW Forest Project Leader.
- Mark timber sale area according to prescriptions in the site plan and corresponding FMZ plan.
- Complete and submit a Chapter 132 Forest Cutting Plan to the appropriate DCR office. Send a copy of the cutting plan to the appropriate conservation commission(s). Send abutters notice to all adjacent landowners within 200’ of harvest area via certified mail.
- Draft timber sale contract, review with Forest Project Leader.
- Mail timber sale prospectus to all vendors on mailing list, and post legal notice of sale in three newspapers.
- Conduct public showing of the timber sale and award contract through a public, competitive bid process.
- Administer timber sale in full compliance with DFW timber sale contract, Chapter 132 cutting plan and Massachusetts Slash Law.
- Establish post-treatment biological monitoring as appropriate. Use monitoring results to modify future harvesting practices as appropriate.

5. Boundary condition and maintenance

A GIS analysis of DFW lands in the Berkshire Highlands FMZ determined that there are about 395 miles of boundary, including about 45 miles of road frontage, surrounding the approximately 33,000 acres of DFW lands in the FMZ. Approximately 150 miles (about 38%) of all DFW boundaries are marked in the FMZ. A geodatabase has been developed to track and prioritize boundary work on all DFW lands with a goal of having all boundaries marked by 2010. A detailed set of boundary marking guidelines were put in place in 2005 to standardize boundary marking materials and methods on DFW lands, and call for all DFW boundaries to be blazed and painted and for GPS waypoints to be recorded at all boundary corners.

VIII. Rare Species Protection

All active management sites are reviewed for occurrence of Natural Heritage Priority Habitats (Table 11) and rare species element occurrences (Table 10). Mitigation recommended by Natural Heritage for conservation of rare species is reflected in the site plan and cutting plan.

The BioMap Project (NHESP 2001) created a statewide map of potential rare species and natural community habitat known as BioMap Core (Fig. 16). The BioMap Supporting Natural Landscape is defined as the portion of the landscape that connects many smaller but important Core habitat areas. The Supporting Natural Landscape in this FMZ provides essential corridors for plant and animal movements. This critical habitat connectivity as well as the long-term open space protection provided on WMAs will serve to enhance the long-term viability of rare species, common species and natural community associations.

All rare species (animals and plant) habitat as well as unique communities and Primary Forest are targeted by the Guidelines as well as this Plan as high priority areas of conservation action. At the earliest possible stage, all management prescriptions are informally reviewed with a member of the Natural Heritage and Endangered Species (NHESP) staff prior to implementation in an effort to keep all field staff up to date on the status of rare plants, animals and communities over time. All management activities are formally reviewed by NHESP staff (for a second time) during the Forest Cutting Plan (MGL Chapter 132) review process just prior to harvest. All NHESP recommendations for the protection of rare plants and animals or priority communities are incorporated into the management prescriptions.

Vernal pools represent an important habitat for biodiversity protection and occur throughout this FMZ. Because some animals are completely dependent upon vernal pools for part of their life cycle, the list of these "obligate" ephemeral vernal pool species includes many rare species. *The Massachusetts Aerial Survey of Potential Vernal Pools* (NHESP, 2001) identified 1322 potential vernal pools and 90 vernal pools have been certified within this Berkshire Highlands FMZ.

All potential vernal pool (PVP) sites on DFW lands in the Berkshire Highlands will be or have been visited by DFW staff and vendors to determine whether or not PVPs are in fact functional vernal pools. In addition, pre-harvest biological monitoring (Table 10) is designed to identify any functional vernal pools that are not already part of the DFW Forestry Program geodatabase. All vernal pools on Division property are afforded the same protection as a certified vernal pool during harvest activities (Fig. 17). These pools, as well as upland habitat that surround each pool, will be protected during harvest activities. Because some animals are completely dependent upon ephemeral vernal pools for part of their life cycle, the list of these "obligate" vernal pool species includes many rare species.

Table 11. DFW Properties in the Berkshire Highlands FMZ with known occurrences of NHESP Priority Habitats.		
Property	**No. of Polygons**	**Acres**
Chalet WMA	7	431.5
Chesterfield WCE	1	52.4
Cummington WMA	2	99.4
Dalton Fire District WCE	4	256.7
Day Mountain WMA	1	108.8
Eugene Moran WMA	1	721.6
Farmington River WMA	3	147.1
Fisk Meadow WMA	1	14.5
Fisk Meadows WMA	2	170.7
Fox Den WMA	1	303.6
Grace A. Robson Sanctuary	1	46.9
Green River Access Area	1	6.4
Hinsdale Flats WMA	2	906.0
Hiram H. Fox WMA	4	700.9
Honey Pot Nha	1	46.8
Hop Brook WMA	1	17.7
Housatonic River Access	1	11.1
John J. Kelly WMA	1	63.0
Leyden WMA	1	82.8
Pauchaug Brook WMA	1	2.9
Peru WMA	4	254.1
Poland Brook WMA	4	136.3
Satan's Kingdom WMA	1	30.5
Savoy WMA	3	176.5
Tekoa Mountain WMA	1	505.1
Walnut Hill WMA	1	90.6
Westfield River Access	2	22.9
Westfield River Access Area	3	71.0
Westfield River WMA	1	31.4
Westfield WMA	1	137.3
Whately Great Swamp WMA	1	12.6
Totals	**59**	**5658.6**

The 1830's Primary Forest map delineates areas of land that were noted and mapped as forest at the time of maximum agricultural development in Massachusetts. These Primary Forests, although probably used as woodlots throughout the agricultural period may contain relatively undisturbed forest soils, as well as forest communities that may be less disturbed than traditional post agricultural lands. Areas delineated as Primary Forest are considered high priority areas for conservation action and protection by both the Guidelines and this Plan.

IX. Non-timber forest products

Although the Division has historically leased a few sites within the Berkshire Highlands FMZ to private individuals for maple sugaring, the production of maple sap or other non-timber forest products is not currently a management objective.

X. Water and soil quality

Through the use of Massachusetts Forestry Best Management Practices, DFW strives to protect the quality of wetland resource areas and integrity of forest soils. DFW requires temporary bridges at annual stream crossings during harvesting operations, and frequently requires the use of forwarders for transportation of wood products to landing sites. Pre- and post-harvest monitoring of forest herbs, shrubs, and tree regeneration help DFW to verify that soil and water quality are fully conserved.

XI. Forest recreation and public access

All Division properties in this FMZ are open to the public for hunting, fishing, trapping, hiking and mountain biking. Few trails are maintained within the Wildlife Management Areas, however, many woods roads, skid roads, and foot trails exist. Each WMA has a parking area that is seasonally accessible by pickup trucks or similar vehicles. Forested portions of state wildlife lands typically provide opportunities for dispersed public recreation throughout hundreds or thousands of acres.

Motorized vehicles are excluded from all WMAs beyond the mapped parking areas. Exceptions are made only by the issuance of special use permits for limited periods of time, for example, logging equipment for timber harvest operations and seasonable snowmobile use on designated trails maintained by members of established snowmobile clubs. These uses are only allowed if they do not negatively impact other management objectives. Special use permits for the Berkshire Highlands FMZ are issued by the District Manager for either the Western Wildlife District or the Connecticut Valley Wildlife District, depending on the location of the use.

A project is underway to map via GPS all road features, motor vehicle, trespass, boundaries, and other property elements,.

XII. Conservation of historic and cultural resources

As noted in Appendix XII of the Berkshire Area Ecoregion Assessment (see: http://www.mass.gov/envir/forest/berkshire_draft/appendix_12.pdf), cultural resources are protected from state and federally funded or approved activities under various laws, including but not limited to:

- M.G.L. Ch 9 ss 26-27c as amended by St 1988 c. 254.
- M. G. L. Chapter 38, section 6B (Massachusetts Unmarked Burial law)
- Massachusetts Environmental Policy Act (MEPA).
- Section 106 of the National Preservation Act of 1966.

To comply with these laws, the DFW Forestry Program, in coordination with the DFW Federal Aid Coordinator submits forest management site plans to the Massachusetts Historical Commission (MHC) for harvesting in areas of potentially high archaeologically sensitivity. Areas of potentially high archaeologically sensitivity are defined by MHC as having slopes of 5% or less, well-drained soil, and distance to a fresh water source of 1000 feet or less . Other factors

include aspect with an eastern component and non-rocky/stony microtopography In addition, the Department of Conservation and Recreation has offered to have their chief archaeologist review DFW site plans to compare them with the Massachusetts Historical Commission's database of 7,000 pre-European historic sites.

DFW attempts to minimize potential impacts on cultural and historical resources by including provisions in timber sale contracts that restricts operation of heavy machinery to dry or frozen conditions , prohibits skidding of wood products to landing sites, and requires a forwarder to transport wood products to landing sites. These provisions seek to minimize disruption of the soil profile below the organic surface layer. In addition, DFW seeks to locate landing areas >50' from cellar holes, and/or on abandoned agricultural sites (which have previously been disturbed) within potentially sensitive archaeological sites. Further, historical and cultural resources such as stone walls, cellar holes, and mill sites are mapped and protected during harvesting operations. DFW seeks to utilize existing openings in stone walls for transporting wood products during harvesting operations, and limits creation of new openings in stone walls to situations where new openings will help avoid the need for a stream and/or wetland crossing.

XIII. Public outreach and comment process

This FMZ plan will be provided in draft form to the public via the Division's web-site and will be announced to the public through EOEA contacts with town conservation commissions and conservation organizations in the Commonwealth. Public comments received at the initial public meeting in Pittsfield on February 24, 2005, are reflected in the draft FMZ plan, and are summarized in Appendix II. Public meetings will be held to solicit oral comments, and written comments on this draft plan will be received by DFW until November 14, 2005. Send comments to the DFW Forst Project Leader at the DFW Field Headquarters, 1 Rabbit Hill Road, Westborough, MA 01581. Public comments will be reviewed and addressed before submitting the final plan to the Fisheries and Wildlife Board for approval.

XIV. Legal status of the forest and its resources

Division property is owned by the Commonwealth of Massachusetts under Article 97 of the Constitution, Section 15 of Chapter 15 of the Acts of 1976, Section 2(26) and 8 of Chapter 21A as amended pursuant to Chapter 79 and other laws and acts. The Division also holds conservation easements on some privately owned land, but those forest lands are not managed by the Division and may or may not be subject to Division Forest Management Guidelines.
Individual site plans identify any specific easements, restrictions, or leasing arrangements on Wildlife Management Areas.

XV. FSC Required Element Tracking

FSC certification of sustainable forest management on DFW lands requires that specific elements be covered in management planning documents. The required FSC elements, and the portion of the draft FMZ plan where the elements are addressed are presented in Appendix III.

References

Alerich, C.L. 2000. Forest statistics for Massachusetts: 1985 and 1998. Resour. Bull. NE-148. Newton Square, PA: U.S. Dept. of Agriculture, Forest Service, Northeastern Research Station. 104 p.

Anderson, M.G. and S.L. Bernstein (eds.). 2003. Planning methods for ecoregional targets: Matrix-forming ecosystems. The Nature Conservancy, Conservation Science Support, Northeast & Caribbean Division, Boston, MA.

Askins, R.A. 2001. Sustaining biological diversity in early successional communities: the challenge of managing unpopular habitats. Wildlife Society Bulletin 29(2):407-412.

Askins, R.A., J.J. Philbrick and D.S. Sugero. 1987. Relationship between the regional abundance of forest and the composition of forest bird communities. Biological Conservation. 39:129-152.

Bromley, S.W. 1935. The original forest types of southern New England. Ecological Monographs. P61-89.

Brooks, R.T. 1999. Residual effects of thinning and high white-tailed der densities on northern redback salamanders in southern New England oak forests. J. Wildl. Manage.63:1172-1180.

Byers, D. S. 1946. The environment of the Northeast. Pages 3-32 in F. Johnson, editor. Man in Northeastern North America. Robert S. Peabody Foundation for Archaeology, Andover, MA.

Clark, J. S., and P. D. Royall. 1995. Transformation of a northern hardwood forest by aboriginal (Iroquois) fire: charcoal evidence from Crawford Lake, Ontario, Canada. Holocene 5:1-9.

Cogbill, C., Burk, J and Motzkin, G. 2002. Pre-settlement vegetation of New England: composition and environmental determinants. Journal of Biogeography, 29, 1279-1304.

Darey, G.L. and G.S. Jones. 1997. Massachusetts Division of Fisheries and Wildlife: Historical and current perspectives. Mass. Div. of Fisheries and Wildlife. Boston MA. 14p.

DeGraaf, R.M. 1995. Nest predation rates in managed and reserved extensive northern hardwood forests. For. Ecol. Manage. 79, 227-234.

DeGraaf, R.M. 1992. Effects of even-aged management on forest birds at northern hardwood stand interfaces. For. Ecol. Manage. 47, 95-110.

DeGraaf, R.M. and Angelstam, P. 1993. Effects of timber size-class on predation of artificial nests in extensive forest. For. Ecol. Manage. 61, 127-136.

DeGraaf, R.M. and Miller, R.I. 1996. The importance of disturbance and land-use history in New England: implications for forested landscapes and wildlife conservation. In: DeGraaf, R.M., Miller, R.I. (Eds.), conservation of Faunal Diversity in Forested Landscapes. Chapman and Hall, London, pp. 3-35.

DeGraff, R.M. and M. Yamasaki. 2001. New England Wildlife – Habitat, Natural History, and Distribution. University Press of New England. Hanover, NH. 482 p.

DeGraaf, R.M. and Yamasaki, M. 1992. A nondestructive technique to monitor the relative abundance of terrestrial salamanders. Wildl. Soc. Bull. 20:260-264.

DeGraaf, R.M. and Yamasaki, M. 2002. Effects of edge contrast on redback salamander distribution in even-aged northern hardwoods. Forest Science 48(2):351-363.

DeGraaf, R.M. and Yamasaki, M. 2003. Options for managing young forest and shrubland bird habitats in the northeastern United States. Forest Ecology and Management, 185(2003):179-191.

deMayndier, P.G. and M.L. Hunter, Jr. 1995. The relationship between forest management and amphibian ecology: a review of the North American literature. Environ. Rev. 3:230-261.

deMayndier, P.G. and M.L. Hunter, Jr. 1998. Effects of silvicultural edges on the distribution and abundance of amphibians in Maine. Conserv. Biol. 12:340-352.

Department of Environmental Protection. 1994. The Massachusetts Ecological Regions Project. Pub. No. 17587. 16p.

Engstrom, R.T., S. Gilbert, M.L. Hunter, D. Merriwether, G.J. Nowacki and P. Spencer. 1999. Practical applications of disturbance ecology to natural resource management. P.313-330 in Johnson, N.C., A.J. Malk, W.T. Sexton, and R.C. Szaro (eds.), Ecological stewardship: a common reference for ecosystem management, Volume 2. Elsevier Science Ltd., Oxford.

Faccio, S. D. 2003. Postbreeding emigration and habitat use by Jefferson and Spotted salamanders in Vermont. Journal of Herpetology 37:479-489.

Fleming, M., C. Lahiri, B. O'Connor, J. DiMaio, J. Scanlon, P. Swain, P. Lyons, T. Mahlsted and R. Mellace. 2005. A landscape assessment and management framework for the Berkshire ecoregions in Massachusetts. Massachusetts Executive Office of Environmental Affairs, Boston, MA.

Forbush, Edward H. 1907. Useful birds and their protection. Massachusetts State Board of Agriculture.

Forest Stewardship Council. 2002. Final Forest Stewardship Standard for the Northeast Region (USA), Version V7.7, including the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. Northeast Region Working Group, Forest Stewardship Council, U.S. Initiative.

Foster, D.R. and Motzkin, G. 2003. Interpreting and conserving the openland habitats of coastal New England: insights from landscape history. Forest Ecology and Management 185 (2003) 127-150.

Foster, D.R., Motzkin, G., Bernardos, D. and Cardoza, J. 2002. Wildlife dynamics in the changing New England landscape. Journal of Biogeography, 29, 1337-1357.

Foster, D.R., G. Motzkin and B. Slater. 1998. Land-use history as long-term broad-scale disturbance: regional forest dynamics in central New England. Ecosystems (1): P96-119.

Foster, D.L., D.H. Knight and J.R. Franklin. 1998a. Landscape patterns and legacies resulting from large, infrequent forest disturbances. Ecosystems (1998)1:497-510.

Franklin, J.F. 1988. Structural and functional diversity in temperate forests. Pages 166-175 In: E.O. Wilson, Ed., Biodiversity. National Academy Press. Washington, D.C.

Fuller, J.L., D.R. Foster, J.S. McLachlan and N. Drake. 1998. Impact of human activity on regional forest composition and dynamics in central New England. Ecosystems (1998)1:76-95.

Gotie, R. and Jenks, D. 1982. Assessment of the use of wetlands inventory maps for determining potential beaver habitat. New York State Fish and Game journal 31(1):55-62.

Hall, B, Motzkin, G., Foster, D.R, Syfert, M. and Burk, J. 2002. Three hundred years of forest and landuse change in Massachusetts. J. of Biogeography, 29:1319-1336.

Healy, W.M. and M.J. Casalena. 1996. Spring seep management for wild turkeys and other wildlife. National Wild Turkey Federation Wildlife Bulletin No. 21.

Howard, R.J. and Larson, J.S. 1985. A stream habitat classification system for beaver. J. Wildl. Manage. 49:19-25.

Hunter, M.L. Jr. 1996. Fundamentals of conservation biology. Blackwell Science, Cambridge, MA.482pp.

Hunter, W.C., Buehler, D.A., Canterbury, R.A., Confer, J.L. and Hamel, P.B. 2001. Conservation of disturbance-dependent birds in eastern North America. Wildlife Society Bulletin 29(2):440-455

Judd, S. 1857. The fur trade on Connecticut River in the seventeenth century, New England Historical General Register N.S.1:217-219.

Litvaitis, J.A. 1993. Response of early seral vertebrates to historic changes in land use. Conserv. Biol. 7(4):866-873.

Lorimer, C.G. 2001. Historical and ecological role of disturbance in eastern North American forests: 9,000 years of change. Wild. Soc. Bull. 29(2):425-439.

Lorimer. C.G. and White, A.S. 2003. Scale and frequency of natural disturbances in the northeastern U.S.: implications for young forest habitats and regional age distributions. Forest Ecology and Management, 185(2003):41-64.

Lutz, H.J. 1928. Trends and Silvicultural Significance of Upland Forest Successions in Southern New England. Yale Univ. School of Forestry Bul. 22.

Mauri, M. 1998. High-grading in Massachusetts: cause for concern. Woodland Steward 28(1):4-7.

Natural Heritage & Endangered Species Program. 2001. BioMap: Guiding land conservation for biodiversity in Massachusetts. MA Div. of Fisheries & Wildlife. Boston MA. 35p.

Nichols, G.E. 1913. The Vegetation of Connecticut: Virgin Forests. Torreya 13: 199-215.

Norton, D. 1999.Forest Reserves. Pp 525-555 in M.L. Hunter, Jr., ed. Maintaining biodiversity in forest ecosystems. Cambridge Univ. Press. New York, NY. 667p.

Patterson, W. A., III, and K. E. Sassaman. 1988. Indian fires in the pre-history of New England. Pages xx, 319 in G. P. Nicholas, editor. Holocene human ecology in northeastern North America: Interdisciplinary contributions to archaeology. Plenum Press, New York.

Pough, F.H., Smith, E.M., Rhodes, D.H. and Collazo, A. 1987. The abundance of salamanders in forest stands with different histories of disturbance. Forest Ecology and Management 20:1-9.

Rawinski, T. J. 2000. Fire-maintained oak woodlands in the area of Worcester, Massachusetts: Vegetation ecology, wildlife, and conservation. Massachusetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program, Westboro, MA.

Robbins, C.S., Dawson, D.K. and Boswell, B.A. 1989. Habitat area requirements of breeding forest birds of the middle Atlantic states. Wildl. Monogr. 103:1-34.

Runkle, J.R. 1982. Patterns of disturbance in some old-growth mesic forests of eastern North America. Ecology 63:1533-1546.

Scanlon, J.J., A.M. Kittredge and T.K. O'Shea. 2000. Guidelines for forest management on Wildlife Management Areas. Mass. Div. of Fisheries and Wildlife. Boston MA. 35p.

Seymour, R.M. and Hunter, M.L., Jr. 1999. Principles of ecological forestry. Pp 22-64 in M.L. Hunter, Jr., ed. Maintaining biodiversity in forest ecosystems. Cambridge Univ. Press. New York, NY. 667p.

Seymour, R., Capen, D., Furnish, J. and D. Wager. 2004. Certification evaluation report for the natural forests managed by the Commonwealth of Massachusetts, Executive Office of Environmental Affairs. Scientific Certification Systems, Emeryville, CA. 174 p.

Thompson, F.R. and DeGraaf, R.M. 2001. Conservation approaches for woody, early successional communities in the eastern United States. Wildlife Society Bulletin 29(2):483-494.

Walters, C.J. and C.S. Holling. 1990. Large-scale management experiments and learning by doing. Ecology, 7(16):2060-2068.

USDA Soil Conservation Service. 1988. Soil Survey of Berkshire County, Massachusetts. 216p.

Vora, R.S. 1994. Integrating old-growth forest into managed landscapes: A northern great lakes perspective. Natural Areas Journal 14:113-123.

Appendix I. Summary of Environmental Permitting Requirements

Federal and state laws regulating forest management activities on DFW lands (Prepared by DCR Forestry Staff, and copied from Berkshire Ecoregions Assessment at: http://www.state.ma.us/envir/forest/).

1). Section 404 of the Clean Water Act of 1977 required the US Army Corps of Engineers to control any activities resulting in dredging or filling of waterways, a responsibility that has since been passed on to state agencies.

2). Section 319 of the Federal Clean Water Act Amendments of 1987 tasked the MA DEP with the development of Best Management Practices to control non-point source pollution associated with timber harvests.

3). Section 6217 of the Federal Coastal Zone Act Amendments of 1990 deals with non-point source pollution that affects coastal regions, requiring MA CZM to address problems associated with timber harvests. All harvesting activities in the state are assumed to have the potential to affect the coastal zone, and are therefore subject to Section 6217 requirements.

4). The Source Water Assessment Program, required by the federal Safe Drinking Water Act Amendments of 1996, requires the MA DEP to assess potential threats to drinking water supplies and determine the susceptibility of supplies to these threats. Forest Operations is among the potential threats identified, though the focus of concerns was on "unregulated logging" (i.e. logging that falls outside the jurisdiction of the Forest Cutting Practices Act, described below).

5). MGL Chapter 48 (Fires, Fire Departments, and Fire Districts), especially Sections 16 thru 20 relative to the handling of slash that results from timber harvests in order to minimize fire danger.

6). MGL Chapter 30, Sections 61-62 (Environmental Impact of Projects, etc. Conducted by Agencies) and the Massachusetts Environmental Policy Act (MEPA) regulations (301 CMR 11.00) seek to limit or prevent negative impacts on the environment of the Commonwealth through a review procedure that requires impact reports for activities that exceed certain thresholds. Revisions to MEPA regulations, effective July 1, 1998 determined that MEPA review is not required for forest harvest operations provided that a Chapter 132 Forest Cutting Plan has been filed. A few exceptions exist. An Environmental Notification Form (ENF) and other MEPA review may be required for any non-bridged crossing 1,000 or fewer feet upstream of a public surface drinking water supply for the purpose of forest harvesting activities (bridged stream crossings do not trigger this review). While many projects that occur within a designated Area of Critical Environmental Concern (ACEC) require MEPA review, forest cutting that occurs in an ACEC under a Chapter 132 Cutting Plan is exempt from this review. Forest cutting undertaken *without* a Cutting Plan (e.g., because less than 25 thousand board feet or 50 cords are to be cut) may be subject to MEPA review if it alters an area in excess of 25 acres or occurs within an ACEC.

7). MGL Chapter 131, Section 40 (the Wetland Protection Act), which subjects any activity that alters, dredges, fills, or otherwise harms wetlands to strict regulation.

8). MGL Chapter 132, Section 40-46 (the Forest Cutting Practices Act) and 304 CMR 11.00 require filing of a Cutting Plan for any timber harvest that exceeds 50 cords or 25 thousand board feet, except when clearing for public utilities or highways, maintenance cutting in pastures, cutting for the non-commercial use of the landowner, clearing land for cultivation or pasture, or

change of use cutting (e.g. clearing house lots or mining gravel). (Note that all of these exceptions are subject to Chapter 131 and other environmental legislation). The act and regulations apply to timber harvests on public or private lands, and address wetland protection, wildlife habitat and rare species habitat, and provide minimum environmental standards to which all regulated timber harvests must adhere. Chapter 132 also requires licensing of foresters and loggers who work in Massachusetts. If a Cutting Plan has been filed for a harvest, this harvest is exempt from the procedures required by Chapter 131 and is instead subject to wetland and environmental review by the DCR Service Forester assigned to the region.

9). 314 CMR 4.00 (Massachusetts Surface Water Quality Standards) provides additional protection for Outstanding Resource Waters with exceptional socio-economic, recreation, ecologic or aesthetic values such as public drinking water sources. This protection extends to 304 CMR 11.00 cutting practices regulations, for instance by requiring that stream crossings by logging equipment within 1,000 feet upstream of a public water supply must use a temporary bridge or undergo MEPA review.

10). Federal and Massachusetts endangered species laws and regulations. MGL Chapter 131A (Massachusetts Endangered Species Act) prohibits the taking of any listed MA species. DCR Service Foresters are required to compare a proposed harvesting area on a Cutting Plan to the atlas of listed species habitats provided by the Natural Heritage program, and to contact NHESP for protection guidelines if these overlap.

11). Federal and Massachusetts laws for preservation of historic or prehistoric cultural resources do not apply until sites have been officially listed in the State or National Registers of Historic Places, or have been officially documented to contain prehistoric resources of significance. No sites exist to date within Massachusetts state-owned forestland. However, agency mandates for the protection of such sites, and minimum standards are evolving. Among these and the many other laws and regulations that may impact forest management activities in Massachusetts, the Forest Cutting Practices Act and regulations are the most prominent set of rules that affects forest management on state (and private) forestland. The Massachusetts standard upheld by this act is among the three or four most stringent in the nation, in the company of regulations in the states of Oregon, California, and Maryland. Listed below are some of the minimum environmental standards of these regulations that apply to forest management on all state-owned (as well as private) forests.

1. All trees to be cut (or, in some situations, to be left as seed sources) must be designated by marking, or by a detailed description in the forest cutting plan of the size, species, and quality of trees to be cut and the percentage of the basal area (stocking of trees) to be removed. Management objectives and silvicultural methods must be identified in the cutting plan.
2. Regeneration cuts (including selection system, shelterwood, seed tree, and clear cuts) require either the presence of 1,000 or more viable stems of regeneration per acre, the planting or direct seeding of this many trees, or verification that this condition will be met naturally within five years or fewer. The vast majority of management objectives are met through natural seeding. Intermediate harvests (thinnings) must meet minimum standards for residual stocking.
3. Seed tree and clear cut silvicultural systems also have additional requirements. Seed tree cuts are subject to specific requirements for the number and size of overstory trees left behind. The maximum clear cut opening size is ten acres unless the source of the regeneration is seeding from surrounding stands, in which case the maximum size is five acres. Clearcuts larger than these limits require an approved justification stating the ways in which environmental effects will be reduced, or environmental benefits enhanced by a larger opening size. As noted above, clearcuts in excess of 25 acres may require the filing of an ENF.

4. Filter strips are required along all water bodies and certified vernal pools. The width of these strips is at least 50 feet, but increases with slope for streams wider than 25 feet, ponds 10 acres or greater, designated scenic rivers, and along Outstanding Resource Waters and their tributaries. Also, for all water bodies where the filter strip is 30% or greater in slope, the minimum width increases to 100 feet or to the point between 50 and 100 feet at which the slope drops to less than 30%. Clearcuts are not allowed within the filter strip, with some exceptions. Cutting in filter strips is limited to 50% of the basal area and the trees left behind must be healthy and well distributed. Equipment is not allowed to operate within the filter strip except to access an approved stream crossing.

5. Roads must be designed, mapped, constructed, and maintained according to standards of drainage, erosion control, and slope limitations.

6. Landings must be placed at a sufficient distance from wetland and water resources, must be designed and built properly to limit erosion, must be kept free of trash, and must be stabilized at the end of use.

7. All regulated wetland resource areas must be accurately mapped in the cutting plan and logging is subject to a wide array of restrictions, including where, when, and how equipment is allowed to work on or near wetlands.

8. Stream and wetland crossings are required to meet minimum Best Management Practices (see Kittredge, D.B. and M. Parker, 1995. Massachusetts Forestry Best Management Practices Manual, available through DCR/DSPR Regional offices), with stronger restrictions for stream crossings within 1,000 feet upstream of a public water supply reservoir.

The above is not a comprehensive listing but rather examples that illustrate the regulations for those unfamiliar with the Forest Cutting Practices Act. The full text of these regulations is available online at *www.state.ma.us/dem/regs/304011b.htm*.

Appendix II. Summary of Public Comments prepared by DCR Forestry Staff from Public Meeting in Pittsfield, MA on February 24, 2005.

1. Reserve Areas:

   1.1. No cutting should be done in reserve areas

   1.2. Question the concept that a large-scale reserve is necessary in order to "absorb" a natural disturbance.

   1.3. Managed forests surrounding a medium sized reserve (1,000 acres maximum size) are less susceptible to disturbances that may be severe within the reserve. This manage forest "buffer" is also considered interior forest for the species that require large areas of interior forest.

   1.4. A 5,000-acre reserve could suffer greatly from a single large disturbance. Two (2) separate 1,000-acre reserves far apart could be less susceptible to the same disturbance and would be more valuable.

   1.5. Identified reserves need public input on the social and economic considerations must be discussed with town official, citizens, and private landowners.

   1.6. Support large-scale reserves.

   1.7. DCR and DFW should work together and put private lands in reserves that are adjoining to make the largest reserves as possible and not just to meet a percentage needed for each department.

   1.8. Areas that have been identified as containing especially rich biodiversity and proper historical species distribution should be designated as large scale reserve areas. Other areas that can be improved by active management should be managed as such.

   1.9. Areas that are currently not logged should be identified and perhaps should not count towards the 20% reserve ceiling.

   1.10. Concerned about what will happen to existing (mapped and unmapped) trails within reserves

   1.11. Reserves are a small fraction of the approximately 600,000 acres of public lands. 15,000-acre reserves are necessary because they can withstand large-scale natural disturbances.

   1.12. Concerned about the impact of reserves on "payment of lieu of taxes' and "forest trust fund" payments to towns.

1.13. Understand need for reserves, however most productive lands should and lands with good access should not be in reserves. Specifically October Mountain and Middlefield-Peru State Forests should not be in large-scale reserves.

1.14. Old growth with buffers should be included in the reserve system.

1.15. More baseline information needs to be gathered before reserves are mapped.

1.16. Identification of reserves should be biologically driven.

1.17. Private lands will serve as reserve buffers and be actively managed lands. Concerned about how state lands surrounding reserves will be actively managed.

1.18. Concerned about how private lands, adjacent to reserves will be encouraged to be actively managed

1.19. Support reserves because: the state has the only capacity and capability, except Non-Governmental Organizations such as The Nature Conservancy, to establish large-scale reserves; have seen a lot of bad logging in the Berkshires; and there is no lack of disturbance for edge species.

1.20. October Mountain and Middlefield Peru State Forests need to be reconsidered as large-scale reserves due to the opportunity for tranquility-inspiration values

1.21. Need unique area to be set aside as large and small-scale reserves.

1.22. In some planning areas it may be necessary to set aside greater than 20% as reserves due to less opportunity to establish reserves in other parts of the state.

2. Recreation:

2.1. The State needs to prioritize safety for hikers, birders, etc. from motorized recreation.

2.2. Concerned about motorized vehicle damage to infrastructure (trails, riparian areas, forest values, wetlands, etc.).

2.3. Want to see some areas aread for motorized use (but not all) and zoning for non-motorized use as well.

2.4. Snowmobiles should be regarded as different than other motorized vehicles due to winter vs summer use and less environmental damage because use is over the snow.

2.5. Snowmobile users give back more to the forest than it takes due to volunteer efforts.

2.6. Many forest roads that are not maintained should be maintained for recreational use, fire prevention. Erosion control needs to be a priority on these old roads.

2.7. How will motorized recreation be enforced?

2.8. How will any use including reserves be enforced?

2.9. How will funding be provided for enforcement?

2.10. Require-raise motorized recreation license fees to fund enforcement and environmental education.

2.11. Need more interpretation resources (displays, talks, nature hikes, etc.)

2.12. Consider prohibition of summer motorized vehicle use on state lands.

2.13. Unauthorized trails should not be automatically grandfathered into the trail system.

2.14. Funding is inadequate to put resource management plans into practice.

2.15. State could train volunteers to establish and maintain trails to approved standards.

2.16. Enforce existing regulations that limit use on specific trails.

2.17. Education to make people aware of damage by unauthorized trail uses.

2.18. Consider limiting motorized recreation use to in-state users.

2.19. Appalachian trail corridor transects many regions and ecosystems. The AT trail corridor existing protection should be continued and expanded.

2.20. Motorized usage does not have any place in the managed private property and not damage our public lands.

2.21. State lands where motorized use is prohibited, the land has improved, in comparison to where the use is allowed where there is increased damage.

2.22. Excluding motorized recreation use is counter productive because it will place more pressure on private lands.

2.23. Need to control motorized use on state lands through zoning and limit trail to where it is appropriate.

2.24. The Appalachian Trail corridor of 1,000 feet should be maintained as it has been regardless of whether the trail is in a reserve or Active Management Areas .

2.25. Maintain roads and trails to prevent environmental degradation and eliminate user created trail bi-passes when there are wet areas.

2.26. Educate motorized users who are not part of official clubs because they are not aware that they need permission to use private landowner lands to ride their ATVs.

2.27. Law enforcement and users need to be educated to understand the state ATV/ORV laws and regulations.

2.28. Ned to address the many official trails that were built by organizations and the public.

2.29. Will there be new trails planned?

2.30. Reduction in existing trails that may be unauthorized may lead to more conflicts between user groups because there will be less trails.

2.31. There needs to be trails set aside for hiking only especially to remote precipitous areas.

2.32. Need funding for signage and enforcement for the existing condition and regulations and any new ones.

2.33. DCR need staff on the ground to manage-educate-regulate-and police.

2.34. More out-of-state ATV/ORV use state lands. Need to have outreach educational programs to educate these users.

2.35. Implement a tiered fee system for in-state and out-of state users.

3. Biodiversity

3.1. DCR/DFW should work with Friends Groups to conduct studies of natural resources.

3.2. Fund raising should occur to support research.

3.3. State should manage their lands and be supported by the timber sale revenues.

3.4. Do management to sustain habitats through prescribed burning and harvesting.

3.5. Determine if silviculture can benefit rare species.

3.6. State should take a strong stance on controlling/eradicating invasive exotic species.

3.7. What will plantations be converted to, and how will conversions be done?

3.8. Have a resource management plan and follow it.

3.9. Consider increasing the percentage of uneven-aged management to cover a larger component of forestland appropriate with tree species composition.

3.10. Remember that the best use may not be human management. All land that is not reserve should not necessarily go into active management.

3.11. State lands are definitely a place for even-aged management to produce high quantities of quality timber.

3.12. Snags, woody debris, den trees, etc. should be considered during management.

3.13. Aesthetics should be balanced with the goals of securing high quality regeneration (which often requires soil disturbance).

3.14. Focus aesthetic values along roads and trails.

3.15. More emphasis on the return to or protection of forests of pre-manipulated state of tree species diversity, including aggressive elimination of invasive exotic species such as

Japanese barberry, bittersweet) and treatment of stressed species such as White ash, American beech, eastern hemlock.

3.16. Create "heritage" areas.

3.17. Make "fire" prescribed burns part of some of the silvicultural prescriptions.

3.18. Resource management plans need to be real and funded.

3.19. A lot more timber may be harvested from DCR lands. The receipts-revenues need to be dedicated for implementation of the management plans.

3.20. Active Management Areas should be managed as a good example for private landowners demonstrating stewardship for all resources and social benefits that one could receive for forestlands including profit.

3.21. Managed forests should be demonstration areas with interpretation relating the What, Where, Why, When… for educational purposes.

3.22. Timber sale need to be above cost (take in more revenue and benefit then the cost of preparation).

3.23. Make timber sales that are economically viable.

3.24. Do not be afraid to use prescribed fire in the Berkshires if done well and appropriately.

3.25. Would like to walk through some red pine, Norway spruce plantations so do not eradicate all especially if they were planted by the CCC.

3.26. Need to explain what you are managing the forest for in terms of desired conditions such as increasing species viability.

3.27. Hunting on public lands is important and the use should be allowed on public lands especially to deal with the increasing deer populations that are cause forest regeneration and successional problems.

3.28. When balance age classes aesthetic should be considered.

3.29. No need to manage all lands within the Active Management Areas because there will be lands that have poor access, steep slopes, wetlands, etc.

3.30. Need to keep flexibility in the plan.

3.31. Clearcut silvicultural methods should not be eliminated from state lands tools. Perhaps, guidance on the size limits should be established.

3.32. Need large course woody debris in Active Management Areas . Maybe management can establish additional down woody debris.

3.33. Too heavy salvage may be eliminating insect or disease resistant trees.

3.34. Pesticide use should be used for species such as Japanese barberry where appropriate.

3.35. Salvage needs to be thoughtful and if used need to take into consideration site characteristics, regeneration opportunities and difficulties, site potential, etc.

3.36. Herbicides should be used according to labels as well as mechanical means to treat unwanted vegetation.

3.37. In some places within public lands herbicides can be used. The public needs to be informed by public meetings for educational purposes.

3.38. DCR has buildings that are collapsing. The public becomes discouraged when they see this. The state needs to properly maintain their infrastructure especially culturally or historic sites and create a lot of antipathy.

3.39. Boundaries need to be maintained.

3.40. Old fields should be maintained.

3.41. Need to have better fire interagency cooperation and develop fire fighting and the use of prescribed fire policies.

3.42. Make this planning effort an opportunity to make the state lands centers of excellence due to the thoughtful planning and diligent implementation. This should serve as a model or demonstration for others landowners and subsequent planning efforts.

Appendix III. FSC Required Element Tracking

TBD

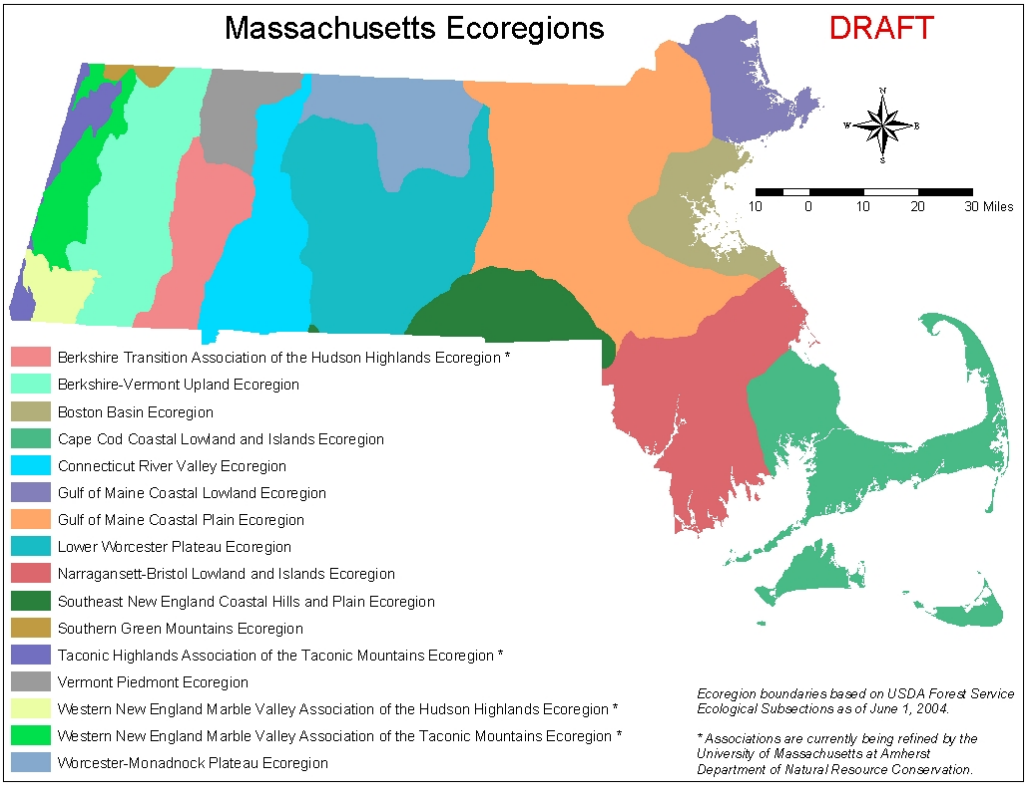


Figure 1. Massachusetts Ecoregions, based on USDA Forest Service Ecological Subsections.

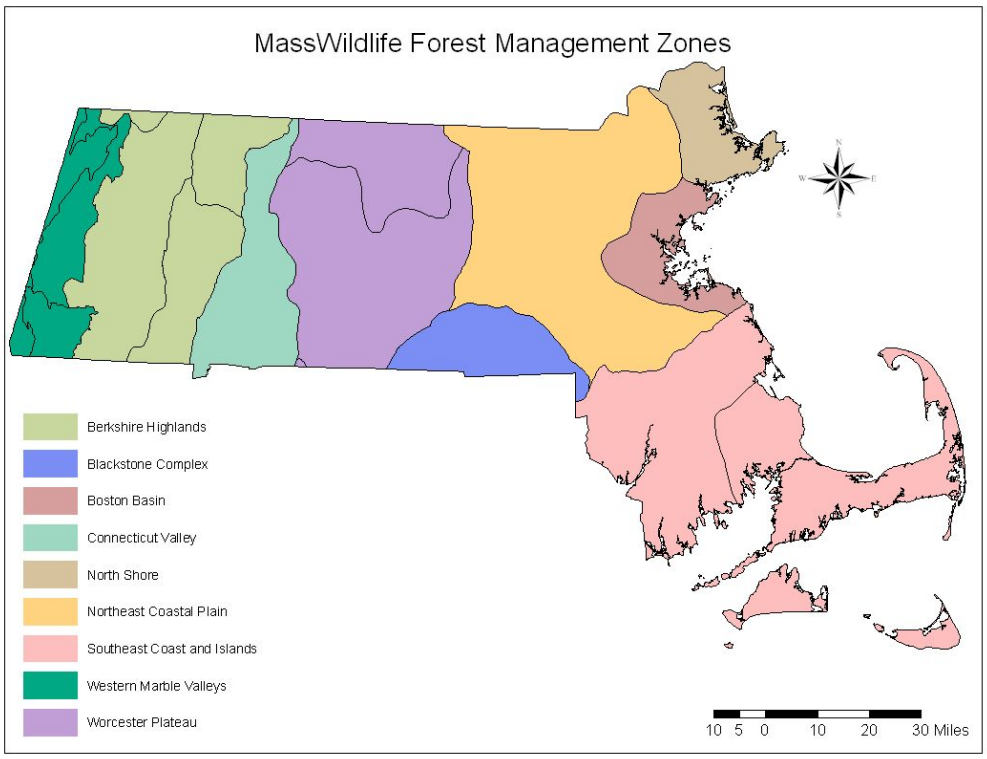


Figure 2. DFW Forest Management Zones with internal ecoregion boundaries shown.

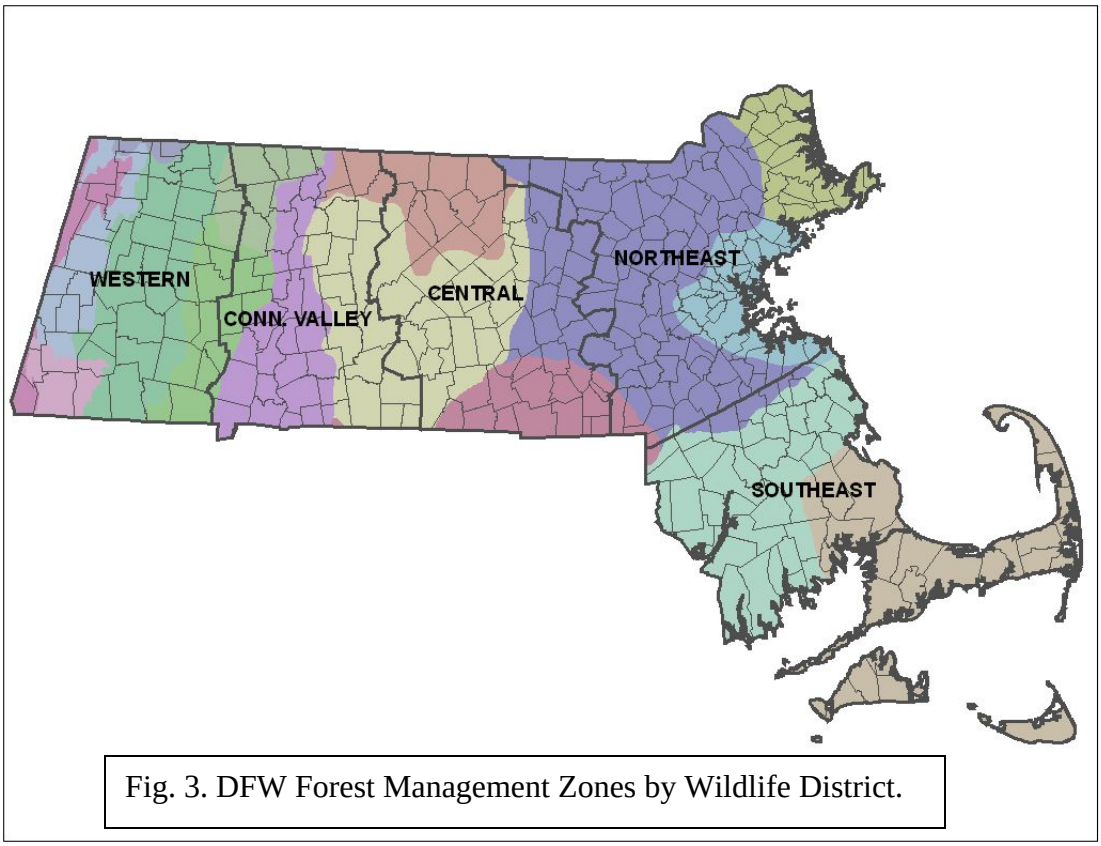


Fig. 3. DFW Forest Management Zones by Wildlife District.

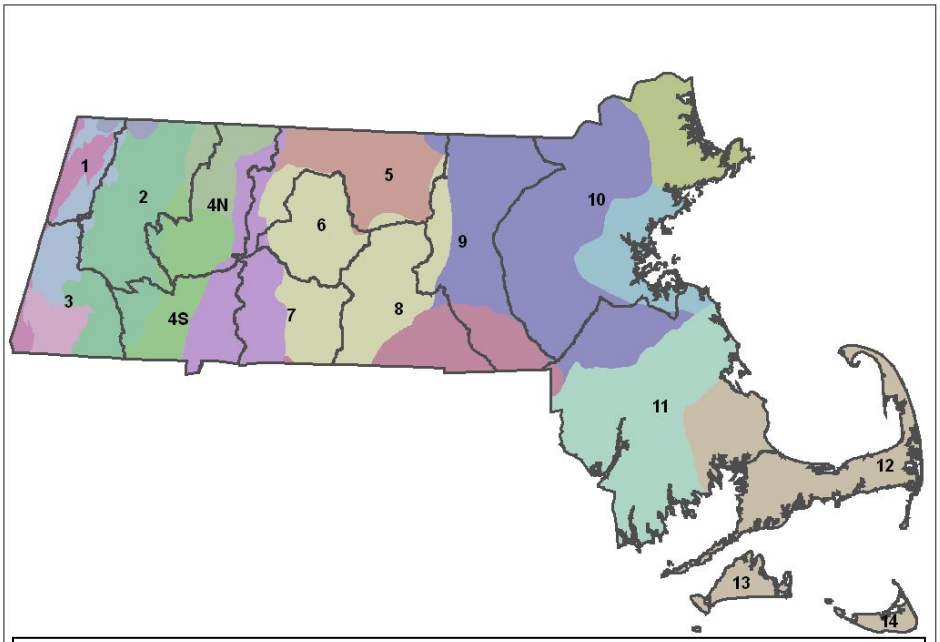
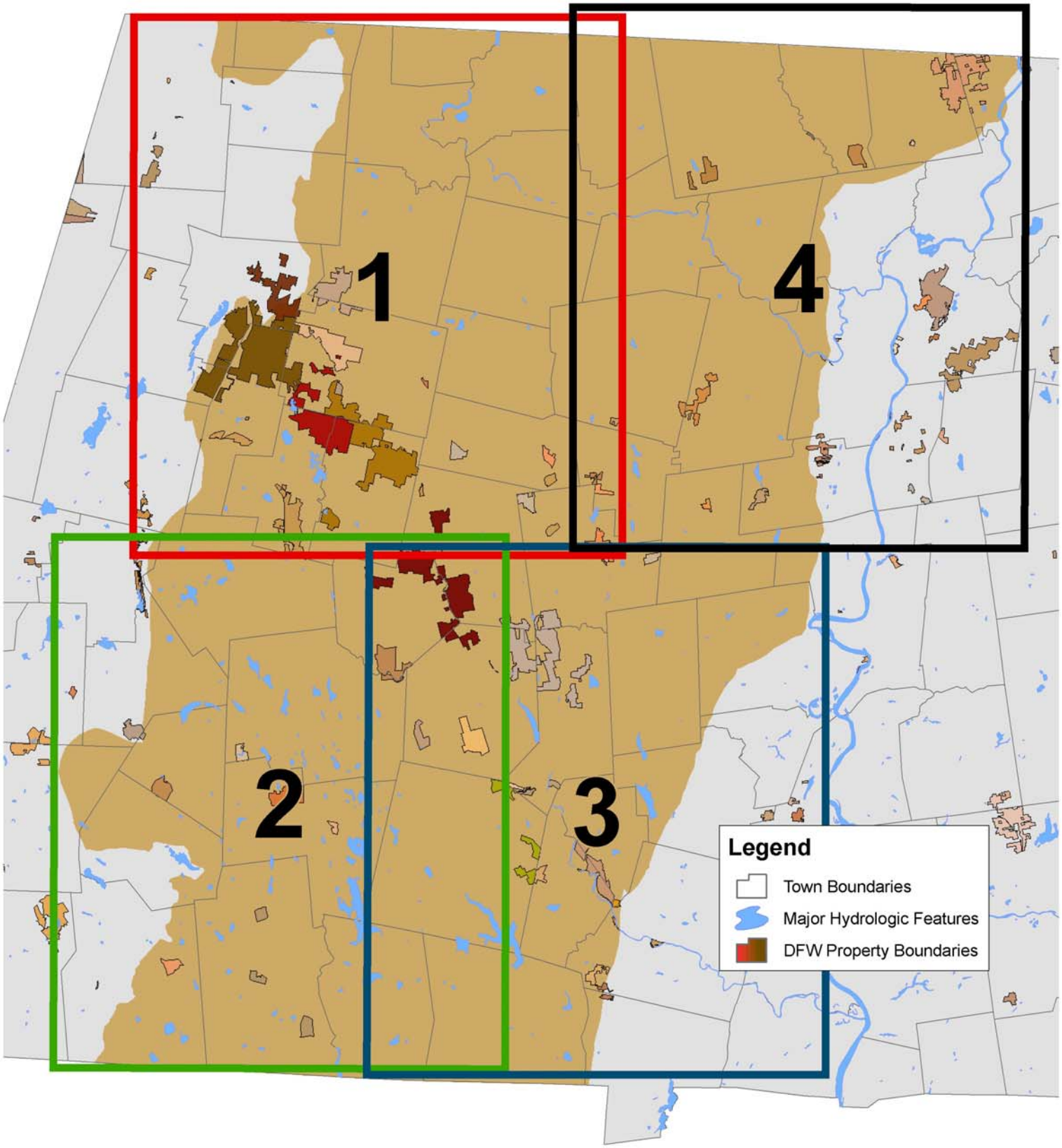


Fig. 4. DFW Wildlife Management Zones and Ecoregions.



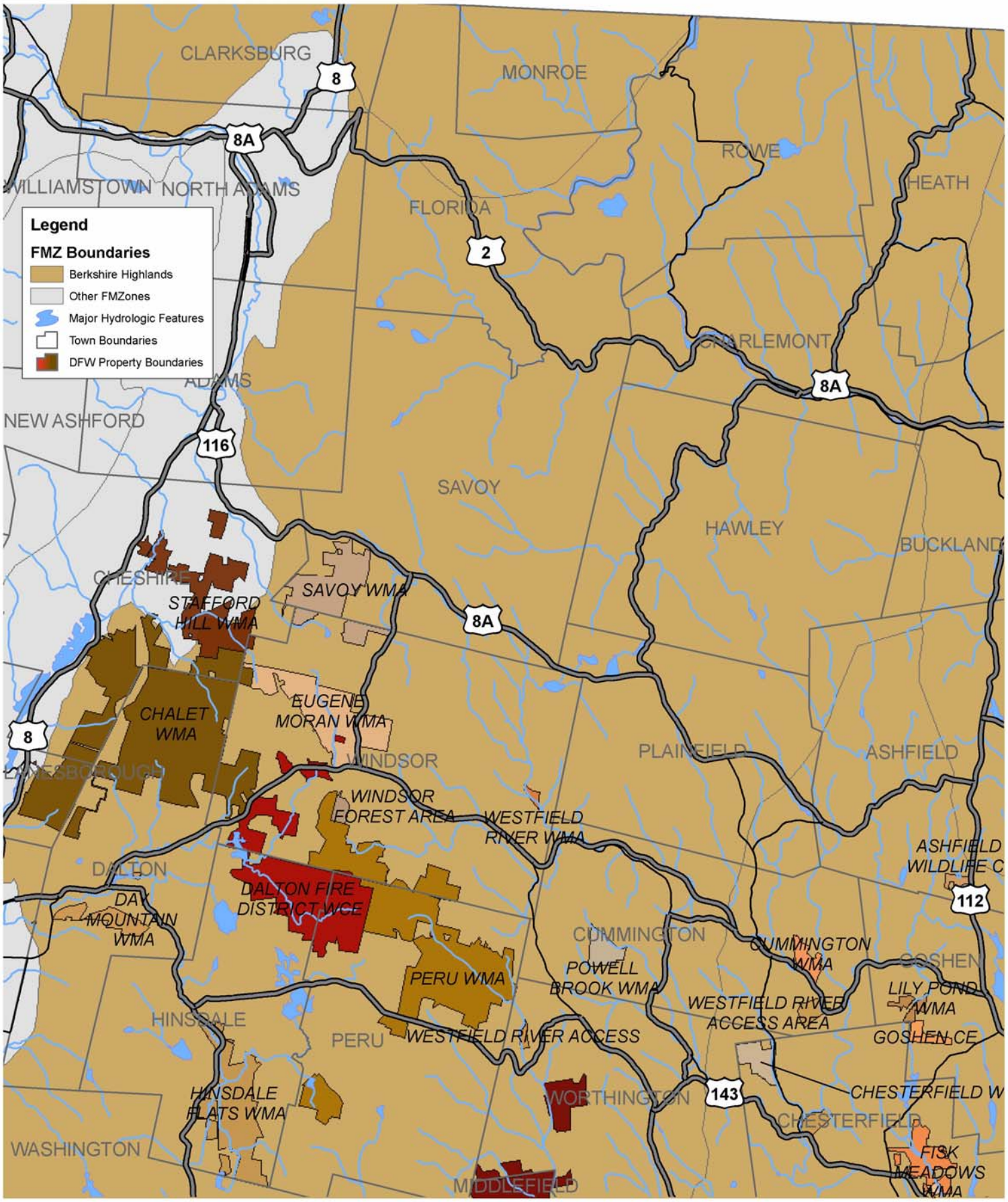
Berkshire Highlands Forest Management Zone (Key to larger scale property maps)

GIS Data: MassGIS (major hydrologic features, major highways, DFW properties taken from protected open space). All data MA State Plane, Mainland, meters.

0 2.5 5 10 15 Miles

N

1:375,000



Berkshire Highlands Properties (Map 1 of 4)

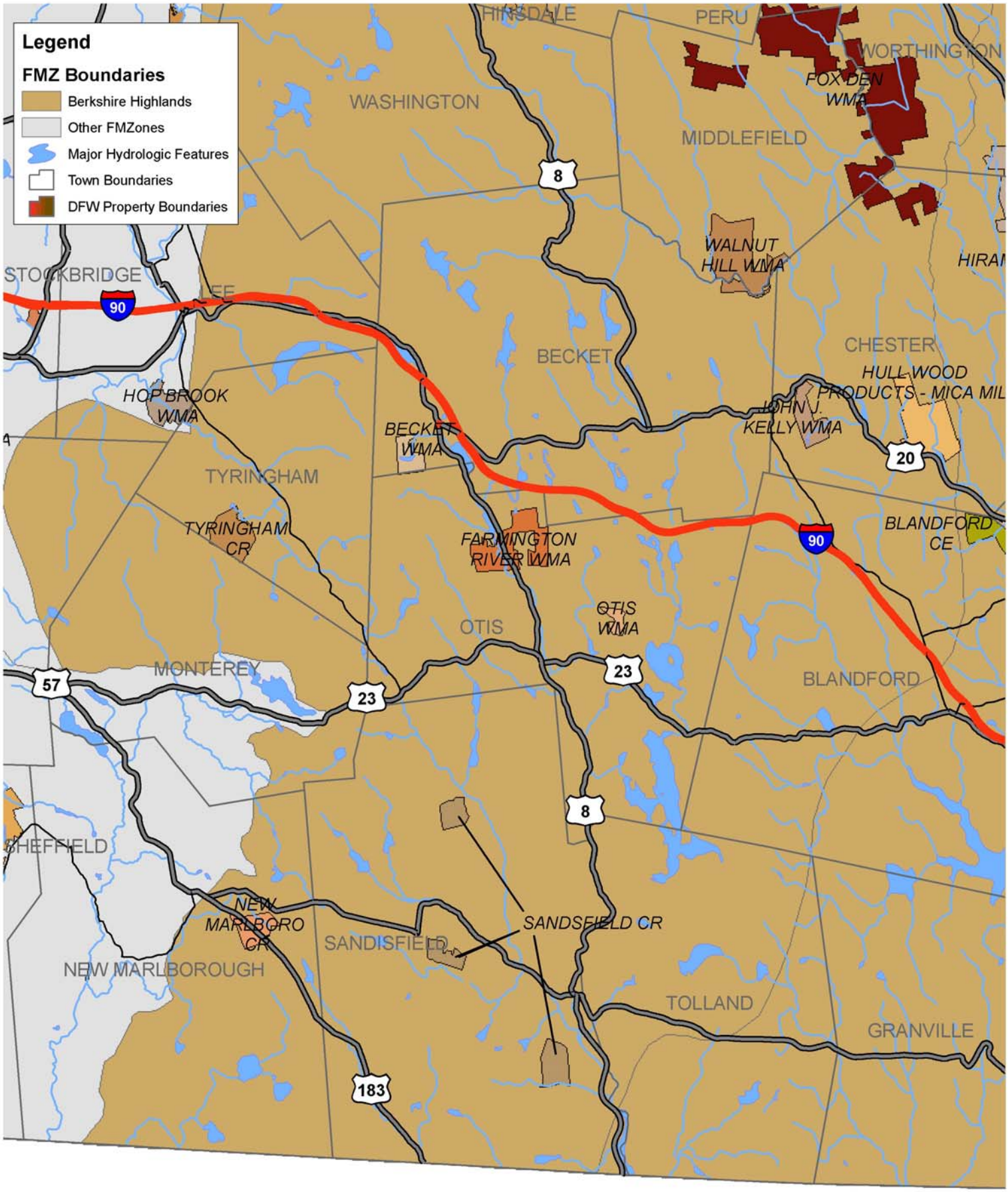
GIS Data: MassGIS (major hydrologic features, major highways, DFW properties taken from protected open space). All data MA State Plane, Mainland, meters.

1 4
2 3

0 0.5 1 2 3 Miles

1:160,000

N



Berkshire Highlands Properties (Map 2 of 4)

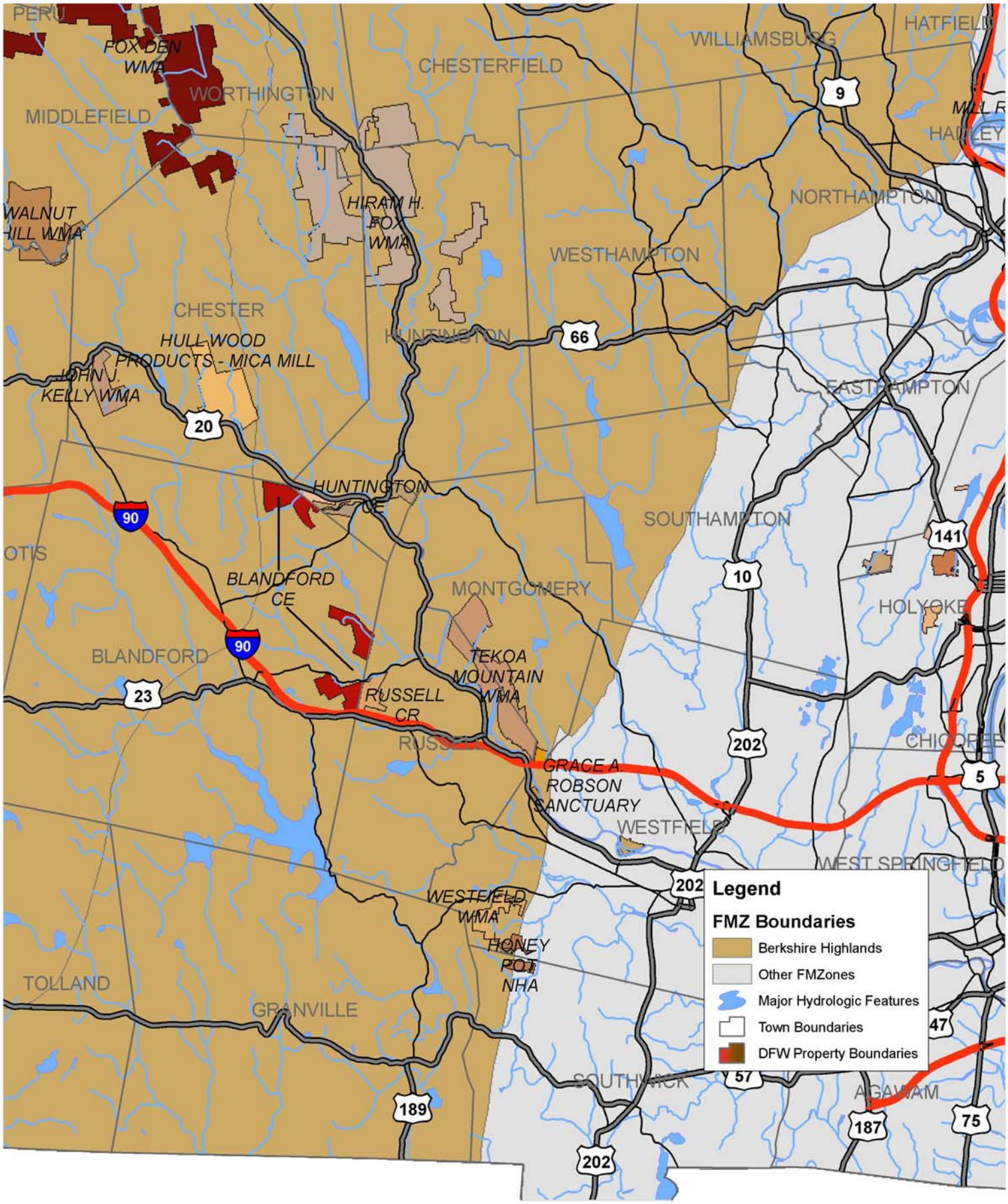
GIS Data: MassGIS (major hydrologic features, major highways, DFW properties taken from protected open space). All data MA State Plane, Mainland, meters.

1 4
2 3

0 0.5 1 2 3 Miles

1:160,000

N



Berkshire Highlands Properties (Map 3 of 4)

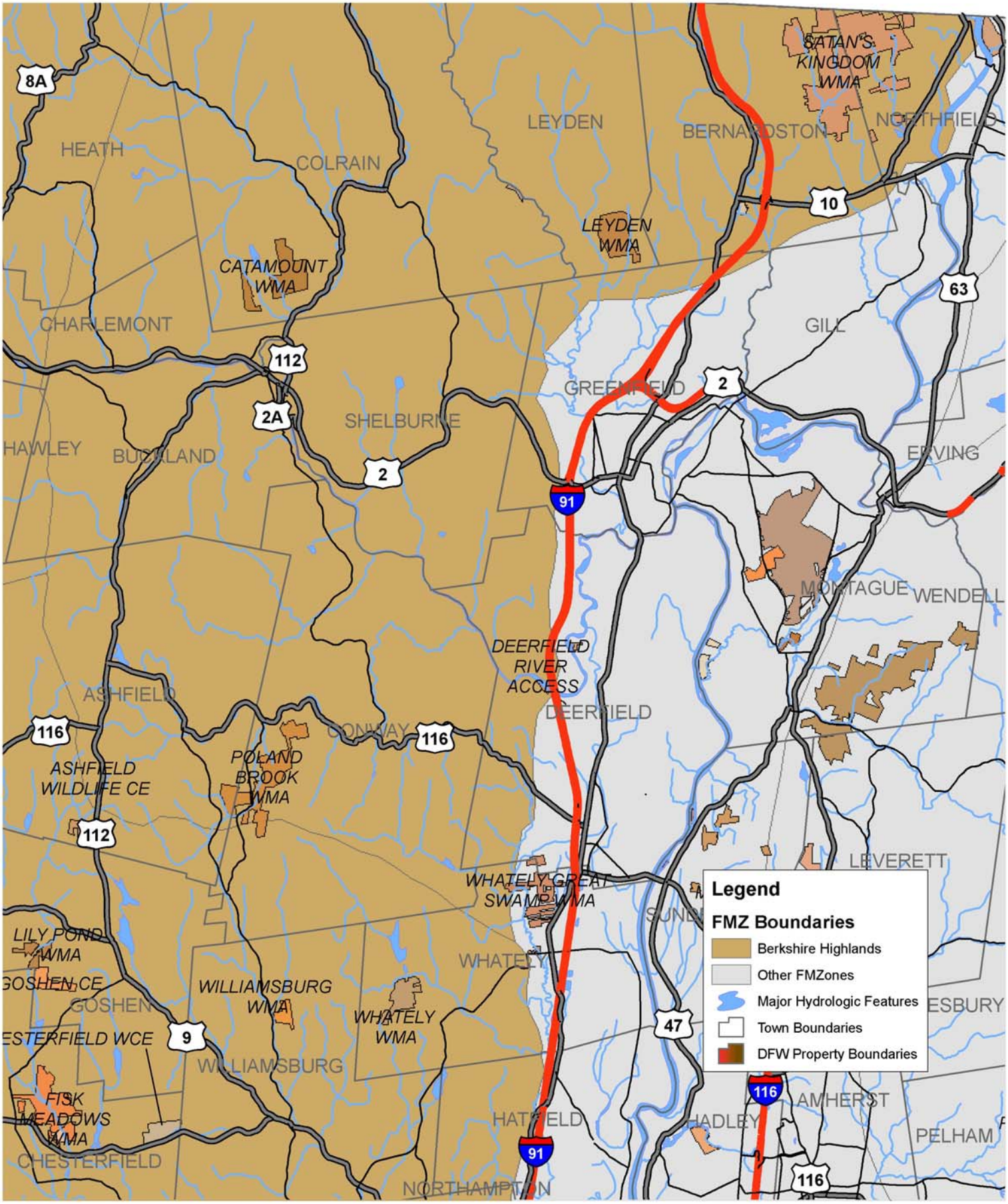
GIS Data: MassGIS (major hydrologic features, major highways, DFW properties taken from protected open space). All data MA State Plane, Mainland, meters.

1 4
2 3

0 0.5 1 2 3 Miles

1:160,000

N



Berkshire Highlands Properties (Map 4 of 4)

GIS Data: MassGIS (major hydrologic features, major highways, DFW properties taken from protected open space). All data MA State Plane, Mainland, meters.

1 4
2 3

0 0.5 1 2 3 Miles

1:160,000

N

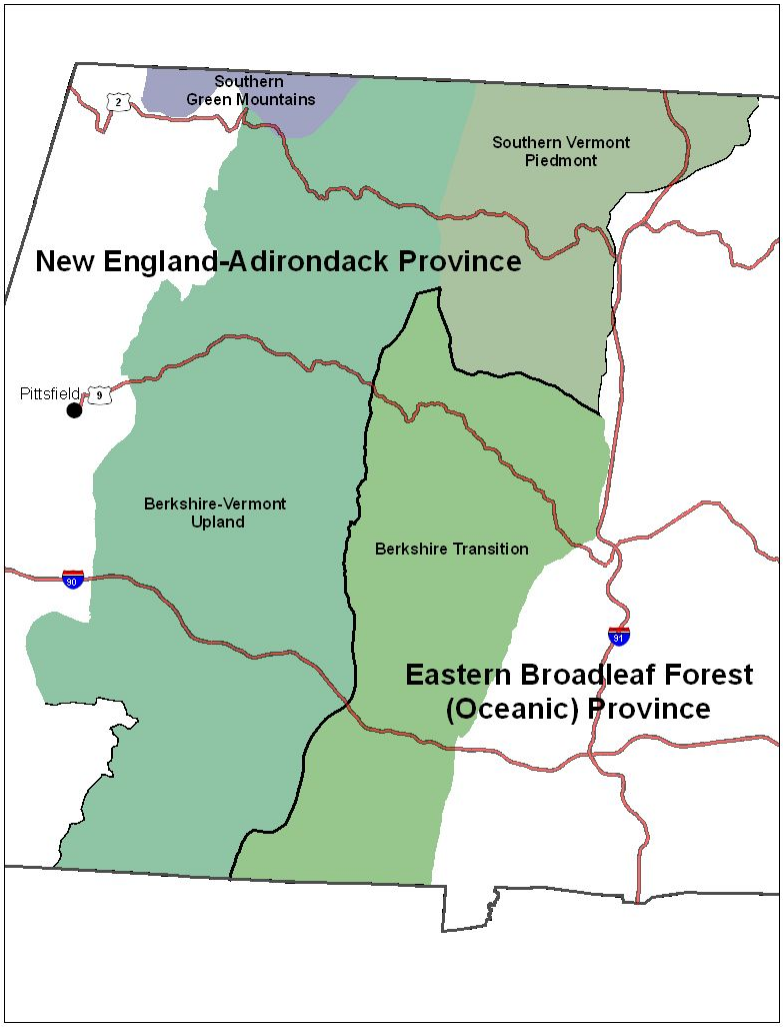


Fig. 6. Ecological Provinces within the Berkshire Highlands FMZ.

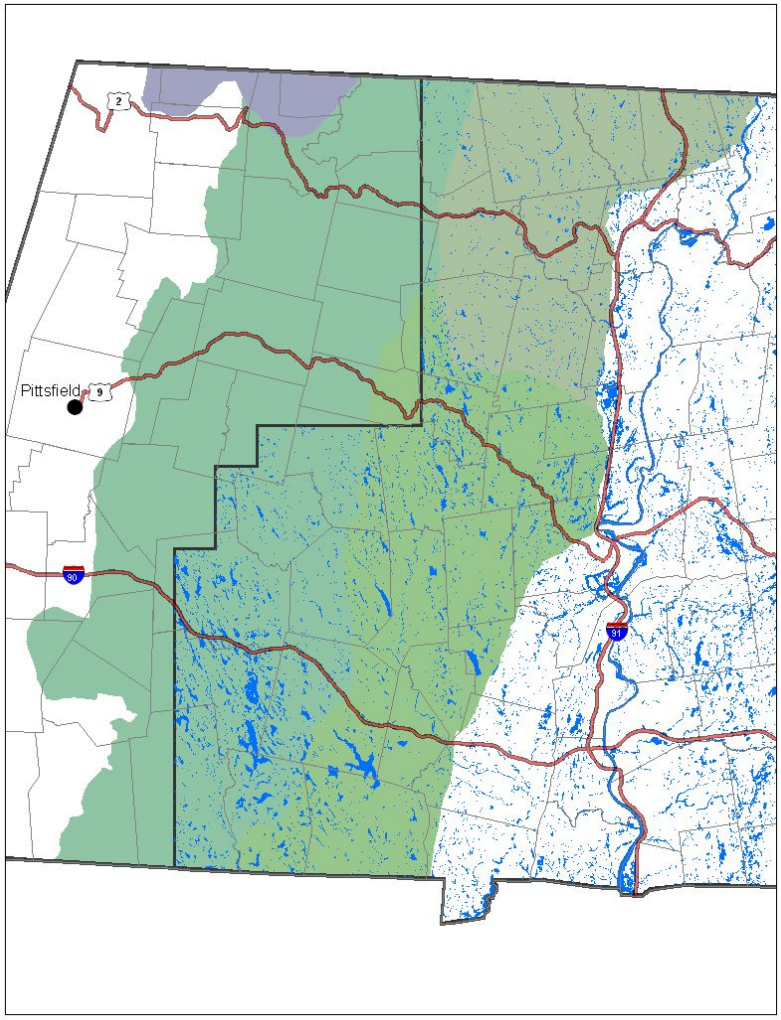
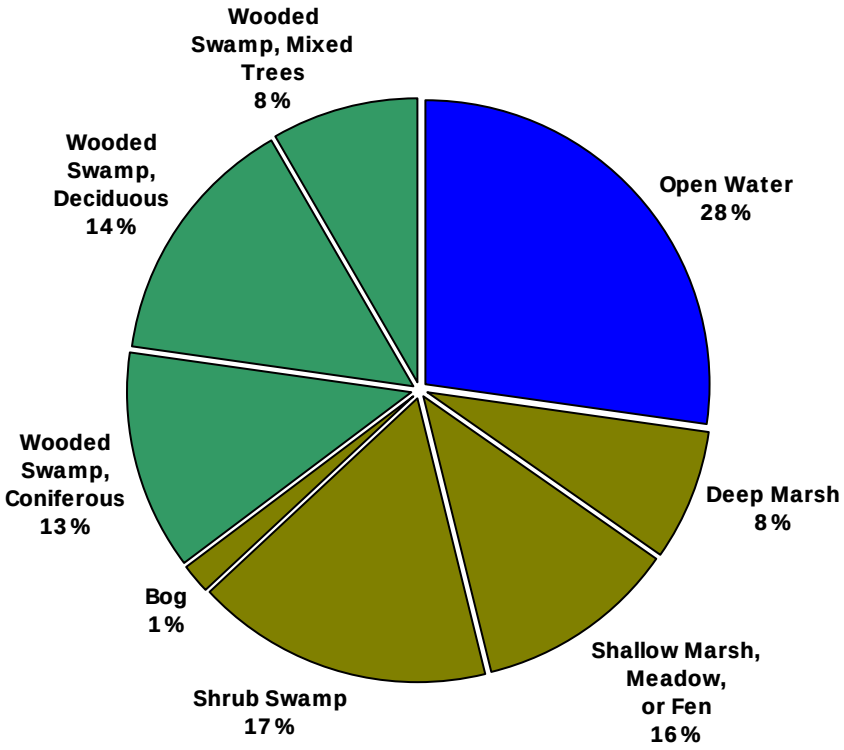


Fig. 7a. DEP wetlands mapping in the Berkshire Highlands FMZ

Fig. 7b. DEP Wetland Types in the BH FMZ.



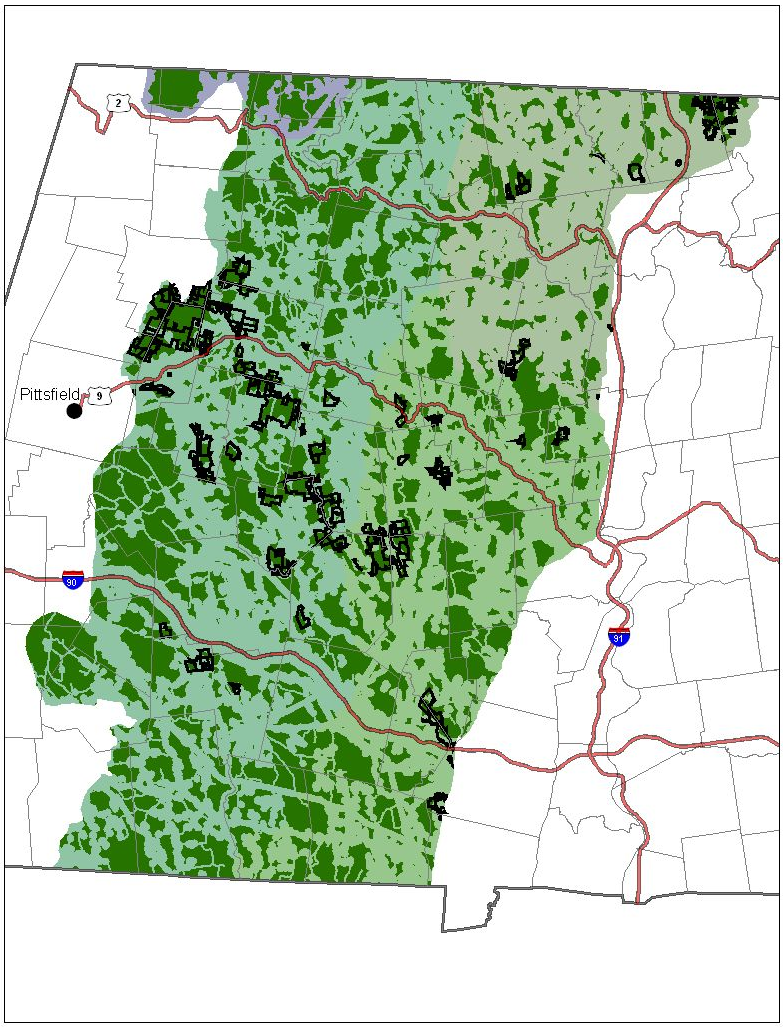


Fig. 8. Interior forest habitat and DFW lands in the Berkshire Highlands FMZ.

Fig. 9. Known 1830 forest cover in the Berkshire Highlands FMZ (from Hall et al. 2002). Grey areas represent towns with no 1830 forest data.

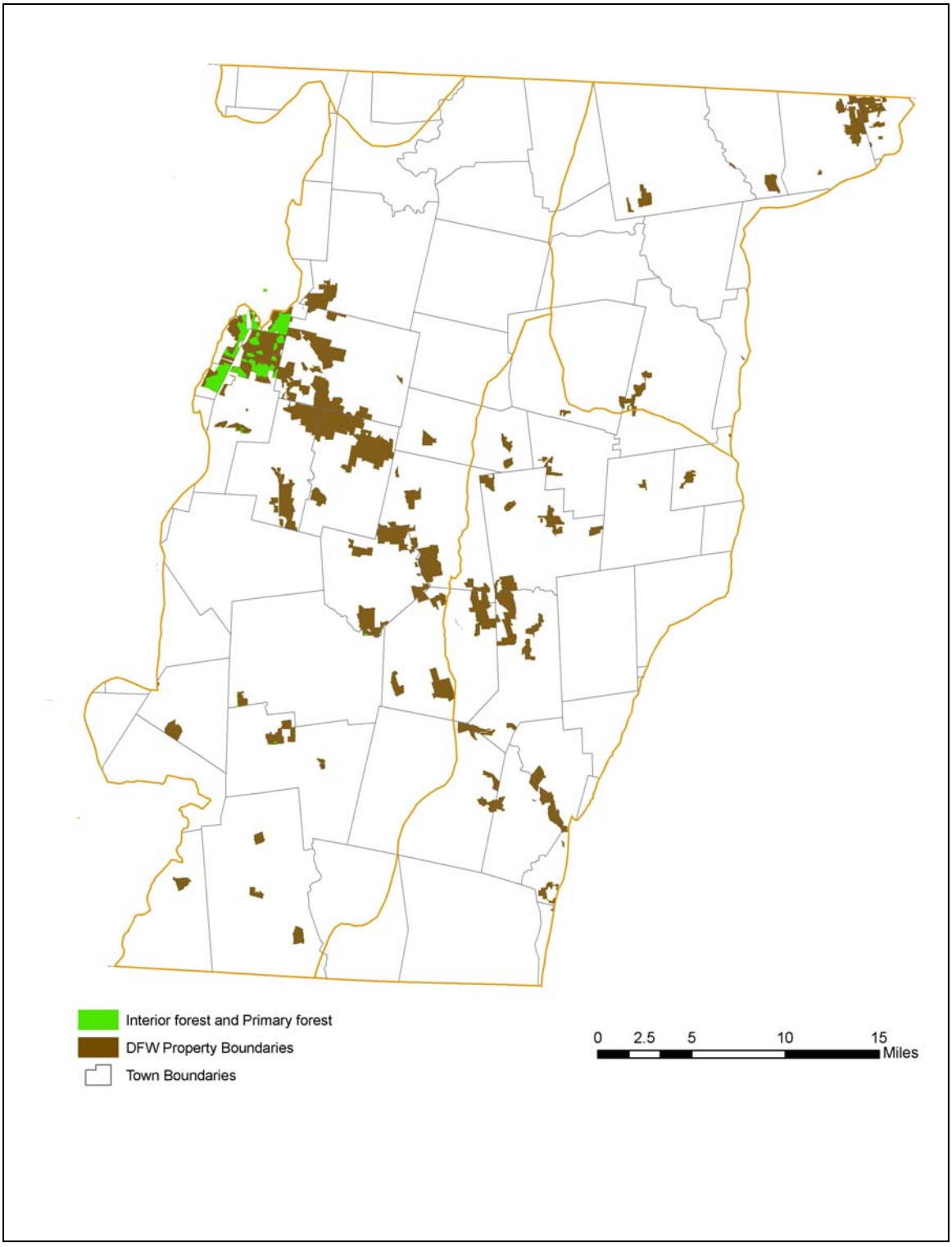


Fig. 10. Overlap of interior and primary (1830) forest on DFW lands in the Berkshire Highlands FMZ (1830 forest from Hall et al. 2002).

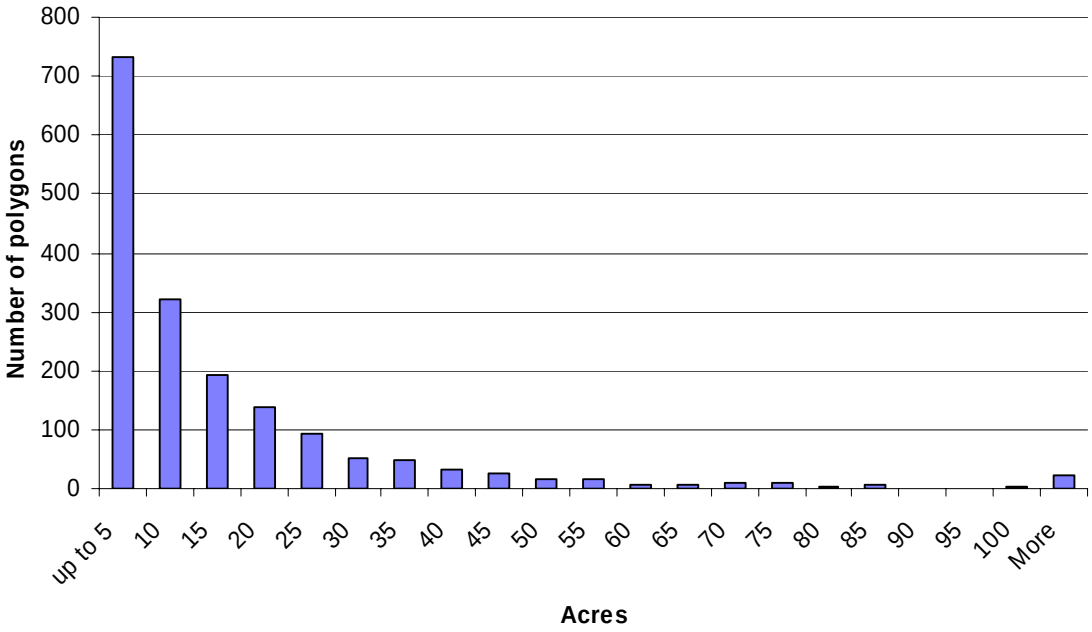


Fig. 11. Forest polygon size for DFW lands in the Berkshire Highlands FMZ.

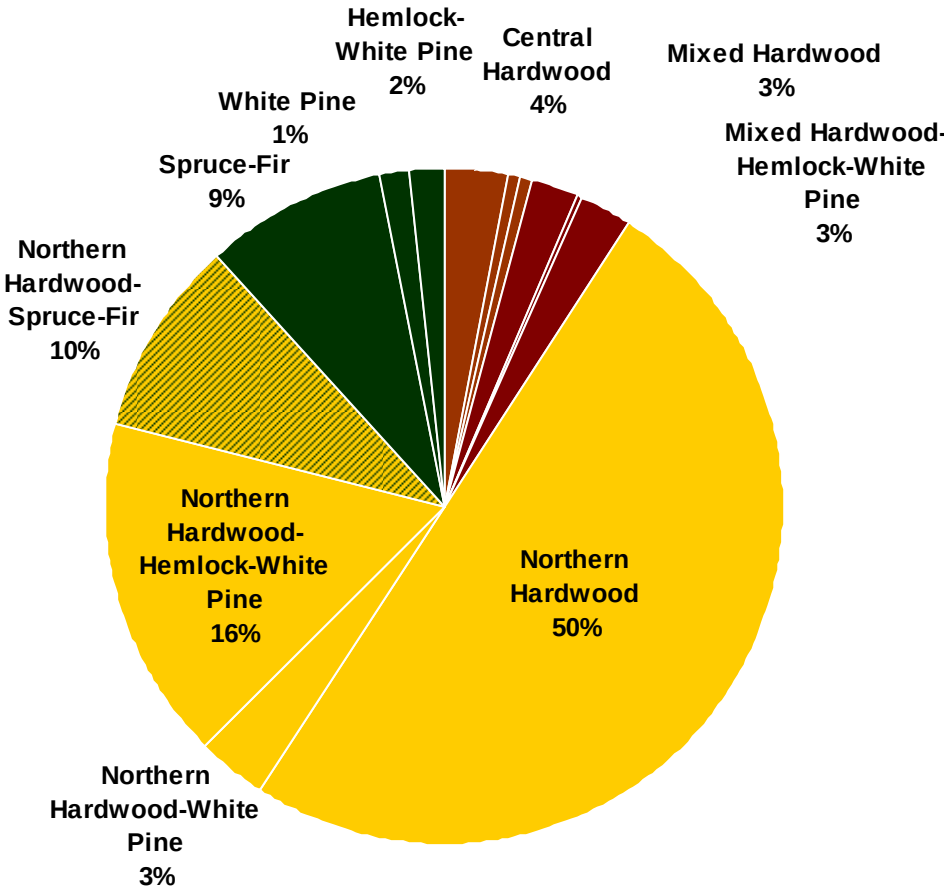
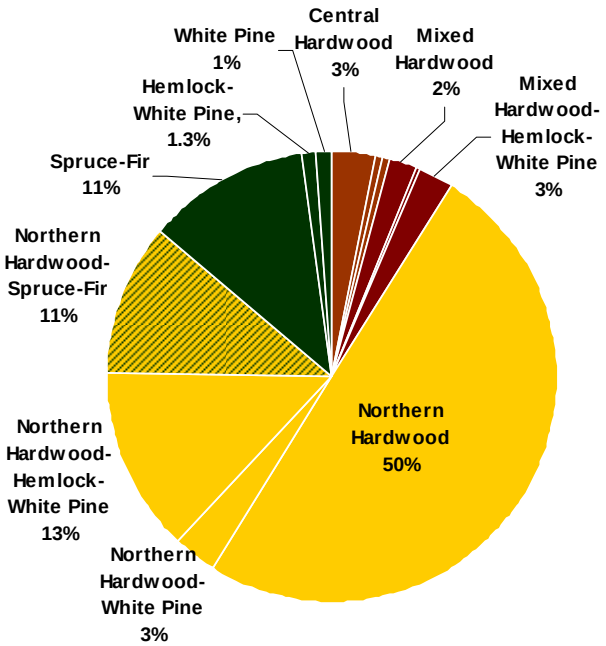
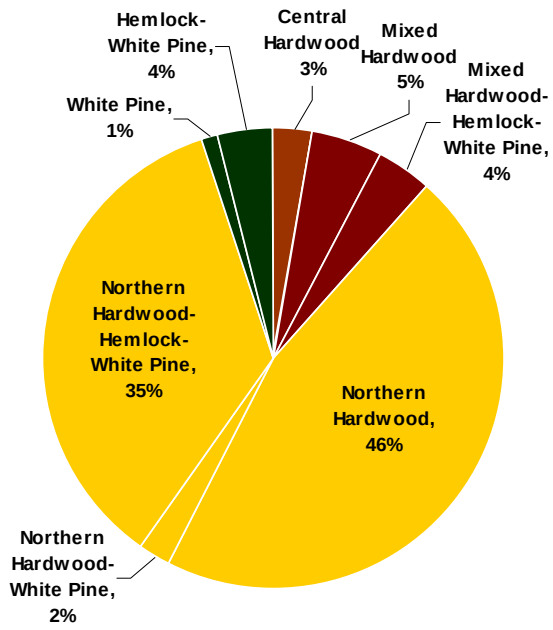


Figure 1. Upland Forest Types on DFW properties in the Berkshire Highlands FMZ overall (above), in the portion of the FMZ in the New England-Adirondack Province (bottom left) and in the portion of the FMZ in the Eastern Broadleaf Forest Province (bottom right).





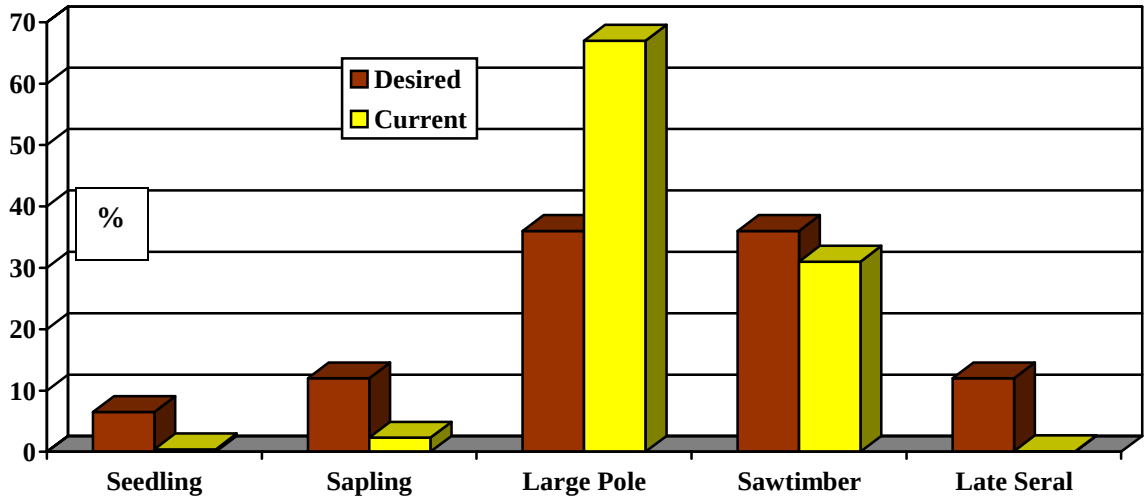
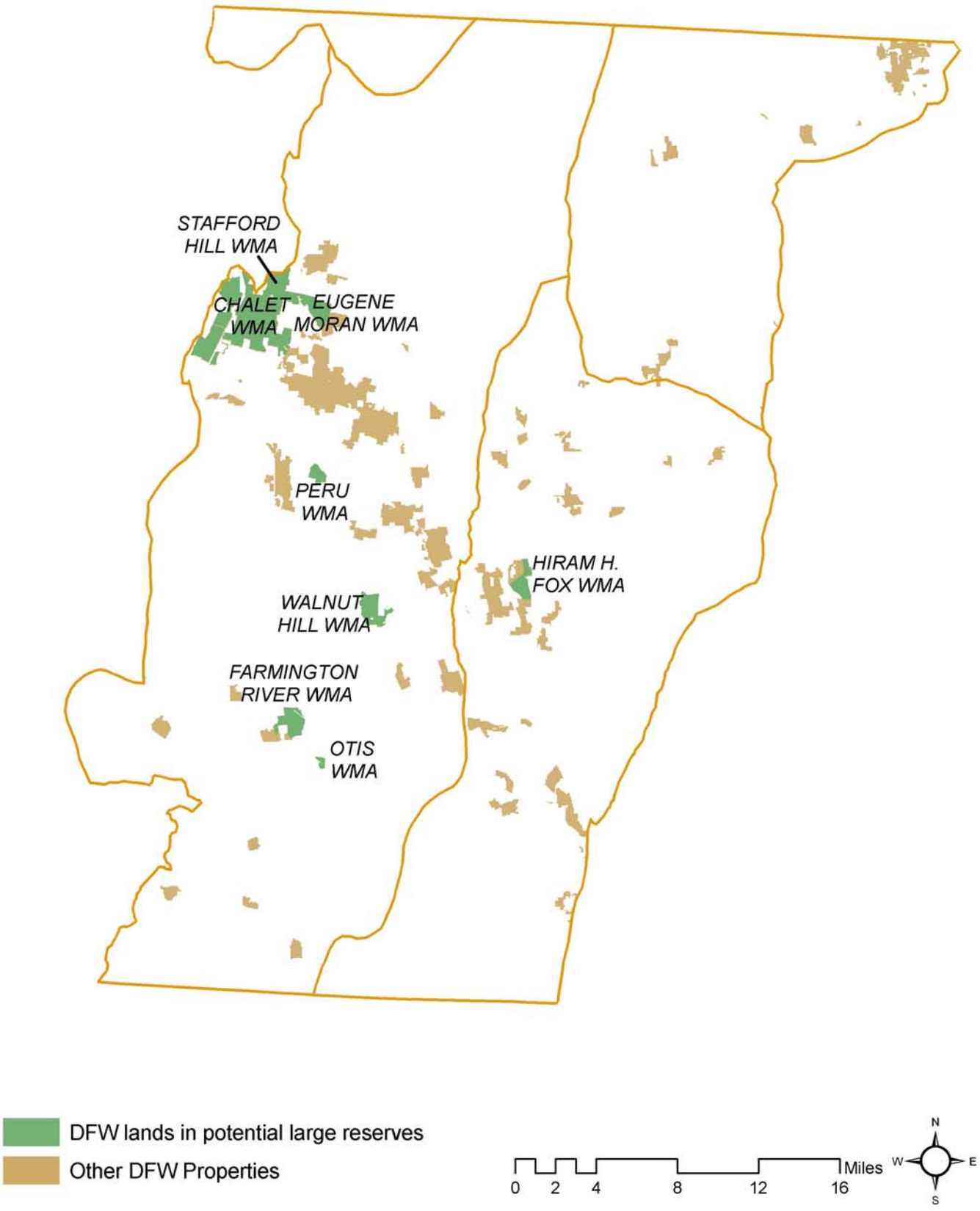


Fig. 13. Forest landscape composition goals for DFW lands in the Berkshire Highlands FMZ by forest age and size class.

Fig. 14. DFW lands in potential large reserves within the Berkshire Highlands FMZ.



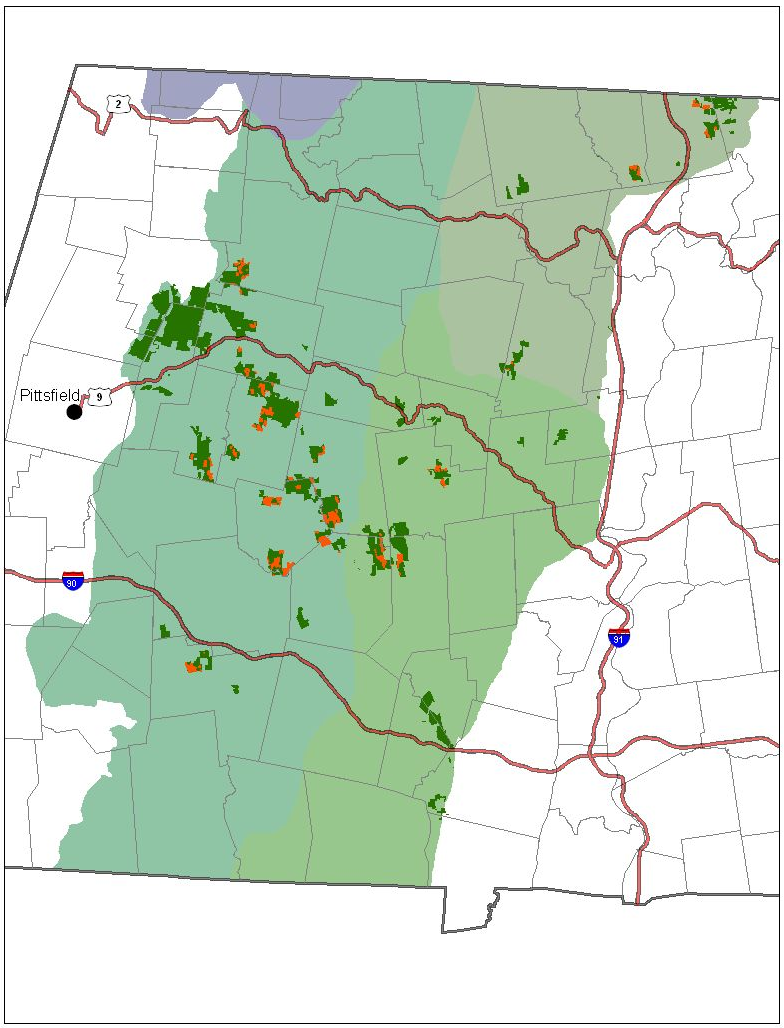


Fig. 15. Potential high priority timber sale sites on DFW lands in the Berkshire Highlands FMZ.

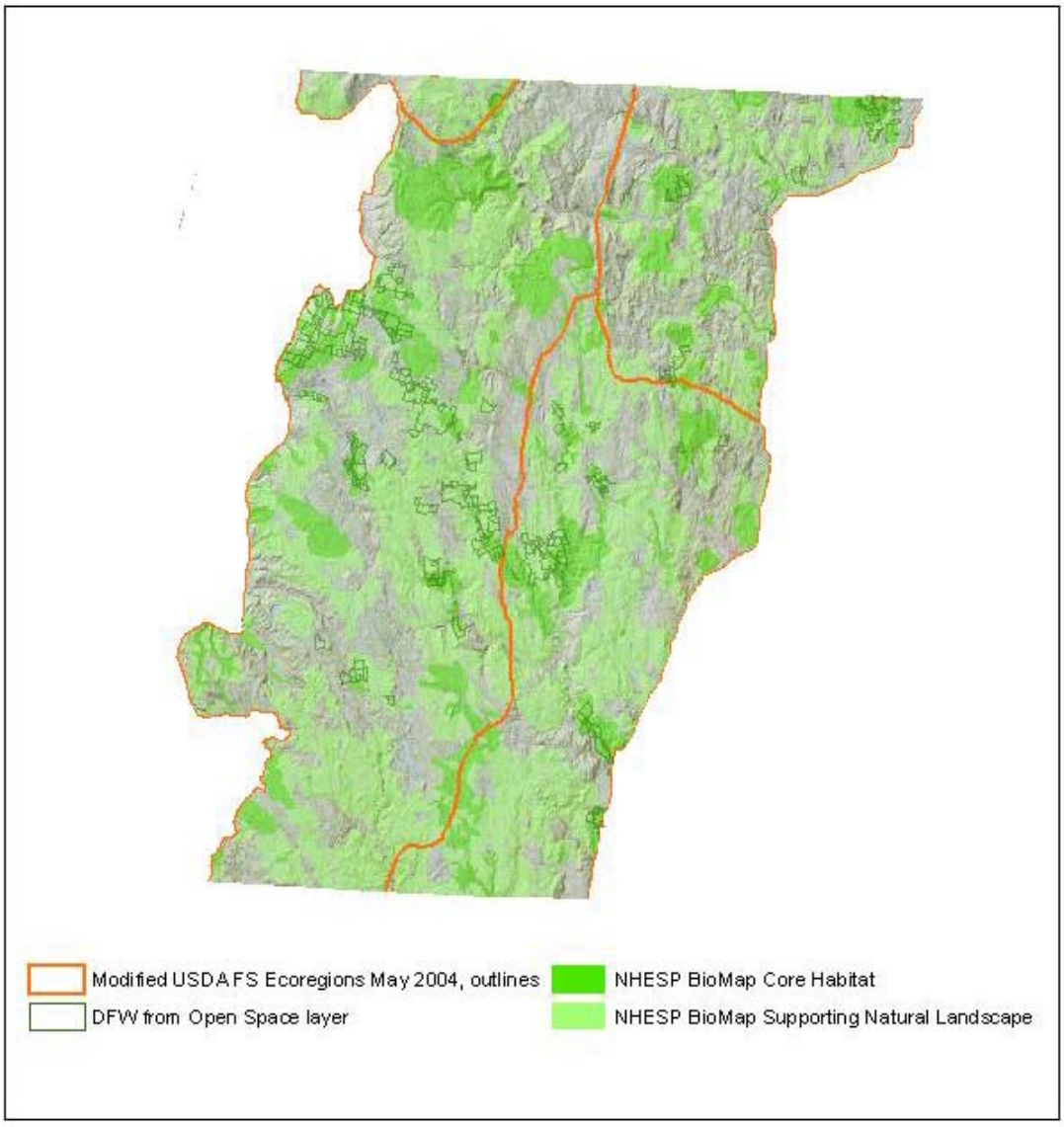


Fig. 16. BioMap core lands in the Berkshire Highlands FMZ.

Fig. 17. NHESP certified and potential vernal pools in the Berkshire Highlands FMZ.